

26. W. K.

NAVIGATION;

OR, THE

ART of *Sailing* upon the Sea.

CONTAINING

A Demonstration of the FUNDAMENTAL
PRINCIPLES of this Art.

TOGETHER WITH

All the Practical Rules of computing a Ship's Way,

BOTH BY

Plain Sailing, Mercator, and Middle Latitude,

Founded upon the foregoing Principles.

With many other useful Things hereto belonging.

To which are added,

SEVERAL NECESSARY TABLES.

*Vela damus, vastumque cavâ trabe currimus æquor,
Postquam altum tenuere rates; nec jam ampliùs ullæ
Apparent terræ; cælum undique & undique pontus:
————— & cæcis erramus in undis.*

VIRG.

The SECOND EDITION, corrected and enlarged.

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Bookseller in Ordinary to His MAJESTY.

M D C C L X I V.



THE
P R E F A C E.

THE art of *Navigation* is of such consequence to this nation, that it is hard to say whether or no we could tell how to live without it. And yet such is the ill luck it has met with, that it has never been treated of with that perspicuity, as so useful an art deserves, nor rendered so easy as to be of general use to the world. For all the books that have fallen into my hands, are either too voluminous for being of any real use, or else they are defective in some points or other; which yet, it is necessary for a mariner to be informed of. And which is worse, authors are not agreed about the truth of their own principles: some crying down plain sailing as erroneous, and not to be trusted at all; and others denying even Mercator's sailing to be true.

I thought therefore I should do some service to the young navigator, by laying down and demonstrating the fundamental principles of this art; and at the same time deducing, from these principles, all the necessary rules for calculating a ship's place; and by making them so short and easy, and disposing them in such order, that the mariner may not be at all puzzled with them: so

that he may have at once, all the rules that are necessary for him to know, as far as mathematical computations have any thing to do in the matter. And because not one in ten, even among masters of ships, will be at the pains to learn Trigonometry or Astronomy; therefore, to supply that defect, I have made all the rules drawn from them so short and plain, that he may equally make use of them, whether he understands these sciences or not; which indeed will save him the labour of learning them: though he is never the worse if he does understand them. And if he does, he may as well have recourse to these short rules, as stay to raise canons every time he wants them.

To this end, I have in the first Part, given several Problems in Astronomy, of frequent use at sea, and such Tables as are necessary to their solution. Likewise easy Rules, for taking an Observation, for finding the Variation of the Compass, the Lee-way of a Ship, the Motion of a Current, with an account of the Trade-winds, the method of placing the Sails to the best advantage; which, though it may be hard to do exactly, yet it will be proper to come as near as one can; with some other things of like kind; all which are some way or other relating to the art of Navigation.

In

P R E F A C E.

In the second Part, you have the demonstration of the principles of what is properly called Navigation, with all the practical rules drawn from these principles, and applied to the solution of the several cases of sailing. Then you have the method of keeping and correcting a Reckoning; and lastly, the method of keeping a Journal of a whole Voyage, to which end all the rest that goes before is directed.

Then follow several Tables, of which the Tables of Sines, Tangents, and Logarithms, go but to five places of Figures, which is abundantly sufficient for any degree of exactness, that Navigation can admit of; and to go further would be needless.

In the Table of Latitude and Longitude of Places, the longitude is reckoned from the *Canaries* as anciently, or from the westernmost part of the continent of *Africa*; that whimsical humour of many modern geographers, of counting the longitude from the metropolis of their own country, has brought all into confusion. And the same confusion must attend the practice of some persons, who, pretending to draw maps and charts, put the east or west end uppermost, according as their fancy directs them, though contrary to the established rules of *Geography*; by which the upper part ought always to be the north. To this I may also add, the giving old names to

A 3

new

new places, as *New England*, *New Spain*, *New York*, &c. which betrays a barrenness of invention in those that impose them, as well as induces a sort of obscurity and confusion in the use of them.

The Table of Meridional Parts, here given, is calculated for the Sphere; for I look upon it as an idle refinement, to deduce them from the Spheroid; for this would require all the parallels of latitude, and arches of the meridian, to be altered accordingly; which would create an endless deal of trouble, for no real advantage. For if we consider, that no ship can steer true to a degree, or hardly to a quarter point of the compass; nor can measure her distance sailed by the log, to any such degree of exactness, but there will always be a considerable variation from the precise truth, in regard to the place of a ship: and for this reason she is obliged, as often as possible, to correct her latitude and longitude by observation. Therefore it would be quite trifling to descend to such minute circumstances, as can have no sensible effect in practice: and such is the difference between the Sphere and Spheroid. Add to this, that if the earth be a Spheroid, its species is not known, which entirely prevents any just calculation to be made on such a principle. And therefore since we must needs wander a little from the truth, we had better do it in a plain and easy way, than in a rigid and difficult one.

But

But as a full answer to all objections of this kind: as the seaman is obliged, from time to time, to correct his reckoning by observation; this wipes away at once all such trifling errors and irregularities, as arise either from this or any other accidental cause.

All the Rules here laid down for practice, I have made as short and plain as possible; the reader having occasion for no more than a little Arithmetic and practical Geometry; for the seaman ought not to be incumbered with long tedious rules. And I am in hopes that what is delivered in this little book, will answer his end, and give him as much satisfaction as any he will ever meet with, and I think too, as much as he can even wish for.

W. E.

P. S. In this second Edition, several of the Rules are made shorter. The Tables of the right Ascension and Declination of the Sun and Stars, which grow erroneous in a number of years, are rectified to the present time. The Table of the Latitude and Longitude of Places is more correct. The Tables of the Eclipses of *Jupiter's* first Satellite, being too slow by a few minutes, I have corrected, so as to agree with observations. Yet it must be owned, that there are no tables extant, that will give the times of these eclipses, so exact as could be wished for.

W. E.

ADVERTISEMENT.

WHEREAS this book of Navigation has been severely censured, because I have drawn my calculations from the consideration of the Sphere, and not from the true Spheroidal Figure of the Earth, which I never knew. Be pleased, therefore, gentle Reader, to understand, that in order to prevent such gross errors and the fatal consequences arising therefrom, the learned author of *the new Principles of Geography and Navigation*, has founded his calculations upon two Spheroidal Figures of the Earth, quite different from one another, and yet both undoubtedly *true*, take which you will, because the Sphere is *false*. There the ingenious author, by the help of paper scales, and other admirable furniture, and certain new, curious, and truly refined methods of practice, teaches you how to sail to the utmost exactness, perhaps to a few inches; and likewise very civilly shows you the great danger of sailing by Mercator's chart. Therefore, kind Reader, if you have a desire of being let into the *Arcana* of Navigation, forget not to enquire for this book at Mr. *Martin's* shop in *Fleet-Street, London*; which I am confident will give you ample satisfaction.

Hic est aut nusquam quod quærimus.



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EXPLA-

EXPLANATION

R *AD.* Radius.
S. Sine.

Cof. Cofine.

T. or *Tan.* Tangent.

Cot. Cotangent.

Sec. Secant.

Dif. Lat. Difference of Latitude.

Dif. Long. Difference of Longitude.

Asc. Ascension.

Dec. Declination.

Perp. Perpendicular.

Log. Logarithm.

D. H. M. S. Days, Hours, Minutes, Seconds.

D. M. Degrees, Minutes.

E. W. N. S. East, West, North, South.

M. P. Meridional Parts.



NAVIGATION.

DEFINITIONS.

1. **NAVIGATION** is the art of guiding or directing a ship, and computing her way through the sea, from one place to another.

2. *Latitude* of a place, is an arch of the meridian, contained between the equinoctial line and that place. This is reckoned in degrees; and the greatest latitude never exceeds 90 degrees; for the poles are 90 degrees from the equinoctial.

3. *Difference of latitude* of two places, is an arch of a meridian, contained between the parallels of latitude passing through these places. This is also measured by degrees, and miles or minutes, of which 60 make a degree.

4. *Longitude* of a place, is an arch of the equinoctial, contained between the first meridian (where-ever it is) and the meridian of the place. This is measured by degrees, whereof 360 reach round the globe.

5. *Difference of Longitude*, is an arch of the equator, or the degrees contained between the meridians of any two places.

6. *Meridional Distance*, is the distance in miles of any given place from the meridian of another Place. This is counted in the parallel of latitude of the given place.

B

7. De-

DEFINITIONS.

7. *Departure*, is the whole easting or westing a ship continually makes, during any single course in passing from one meridian to another.

8. *Course*, is the angle which the ship's way makes with the meridian.

9. *Rumb*, is the path or line that a ship describes during any one course. A rumb line cuts all meridians in the same angle; and therefore it is a spiral line upon the globe, continually approaching the pole: except in an east and west course, where it coincides with the parallel; and in a north, and south, with the meridian.

10. *Plain Sailing*, is the computing a ship's way by plain trigonometry, with regard to her easting, westing, northing, or southing.

11. *Middle Latitude Sailing*, is a method of computing the way or place of a ship with respect to her longitude, by rules depending on the latitude lying in the middle between two places of the ship.

12. *Mercator's Sailing*, is computing a ship's way, or her place, in regard to her longitude, by help of a table of meridional parts, calculated on purpose, for all latitudes.

13. *Charts*, are maps of the sea and the sea-coasts. If the latitude and longitude be made everywhere equal, it is called a *Plain Chart*: If the meridians are drawn parallel, and besides, the degrees continually increase in proportion to the co-sines of the latitude; it is called a *Mercator's Chart*. There are other sorts of charts, but not so common. But mercator's is the truest, best known, and the most useful for navigation. In all charts the upper end is the north, and the lower the south.

14. *Va*

D E F I N I T I O N S.

3

24. *Variation of the compass* is an arch of the horizon, contained between the meridian of the place, which is a north and south line; and the magnetical meridian, or direction of the needle, or *flower-de-luce*. It is called, *East variation*, when it lies easterly of the north. part of the true meridian; and *West variation*, if westerly.



Instruments belonging to Navigation; and
their Use.

I. *The Sea Compass.*

I. **T**HIS is a circle of paper or pasteboard, called the *Card*, whose circumference is divided into 32 equal parts; every point of division is called a *romb* or *point* of the compass. These points are all named according to their position, and numbered clear round the compass, thus, viz. *North, north by east, north north east, &c.* but only the first letter of every word is put.

On the under side of the card, there is fixed a steel *needle*, touched with a load-stone, in whose center is a hole or cap, which being put upon the end of a small pin, set upright in the bottom of a hemispherical wooden dish, the card and needle play freely upon the end of this pin; and the needle always directs itself towards the north, carrying the card along with it, the *flower-de-luce* always pointing to the magnetical north. This wooden dish turns upon two pins fixed in the

FIG. north and south points of a brass hoop; and the

1. hoop turns upon two pins fixed in the east and west points of a square box: so that however the ship rolls, the compass card always lies horizontal. On the north side of the wooden dish, is a black line drawn, which shews the course. If the card does not lie horizontal, drop a piece of sealing wax underneath the lightest side. Nothing of iron must be suffered to come near the compass.

The use of this is to direct the ship in its proper course. For there being no tracks or high roads upon the sea, to direct her motion, there is no other way but for the person at the helm, so to steer the ship, that the black line on the dish may always stand at the point of the compass the ship is to sail upon.

The mariners compass is so constructed, that the needle lies directly under the meridian, or north and south points of the card; by which means, there is any variation, the north point of the compass does not point to the true north. But it would be much easier for the practice of navigation at sea, if the needle was not fixt to the compass card, but so contrived as either to be moveable under it, or fixt to another card under it that is moveable, about the same center (in nature of a rectifier) going a little stiff with a spring; and to have a small index at the north end of the needle, by which to set it to any degree of variation from the north point. If this was done, and the index always set to the proper variation at sea, the flower de-luce would always point to the true north; and there would be no variation to be allowed for in the reckoning; which would save a great deal of trouble to the mariners and prevent such mistakes as often happen in allowing for variation.

I N S T R U M E N T S.

5

The azimuth compass, besides the card with the FIG. 2. points of the compass, has an index and a thread, which index is moveable about the center, and has two sights; the use of this is to take the azimuth of the sun or a star.

The Log-Line.

This is a cord divided into several parts called 2. knots, each knot or part containing 46 feet: this line is fasten'd to a board called the Log, which board is about seven inches long. To one end of it the log-line is fastened, and to the other much lead as will make it swim upright, just with the head above water. At the lower end is a hole where a pin goes in, which is fastened to a part of the line; and this pin may be plucked out, when the line is run off.

In dividing the log-line there must be allowed next the log 12, 15, or 18 fathom of stray-line, according to the bigness of the ship. At the end of this is put in a red or white rag; and at that place the divisions of the line begin. The reason of this stray line is to veer the log pretty well out of the ship's wake, lest the eddy should suck the log after the ship, and deceive you in the distance.

The use of the log and log-line is to measure the ship's way, or her distance run, by help of a half minute glass. For after the log is thrown in, and the red rag comes to hand, the half minute glass must be immediately turned; and that moment the glass is out, the line must be stopt; then observing the line, as many knots as are run off, so many miles the ship sails an hour. If a line and plummet 9 $\frac{2}{5}$ inches long (reckoning from the center of the ball to the point of suspension) be hung up, it will vibrate 30 times in one glass, if it be true.

FIG. In strictness each knot should be about 50 feet;

2. but it is better to be only 45 or 46, and this agrees best with experience, for the log will drag a little after the ship, and make the measured distance less than it is; and it is better the reckoning be a-head of the ship, than the ship a-head of the reckoning.

A ship's way is commonly measured by degrees, and minutes or miles 60 to a degree; or by leagues, 20 to a degree. But to avoid several tedious reductions, it were better to keep this account of the ship's way, as also of the difference of latitude and longitude, in degrees, and 100 parts of a degree. Ordinary a ship goes about a degree in a day. If the ship's way was kept in cents or hundred parts of a degree, then the knots of the log-line would be 27 feet.

The way the ship makes may be nearly estimated by an old experienced seaman; or it may be known by the distance of two marks on the ship's side; and the time she makes this way, may be measured by a watch, or by a glass, or by the pulse, or by repeating a certain number of words, or by hanging up a pendulum $39\frac{1}{2}$ inches long, to vibrate seconds.

3. *The Sea Quadrant, or Davis's Quadrant.*

3. The sea quadrant is an instrument to take the sun's altitude. It consists of three vanes, *A, B, C*; and two arches *ed, GF*. *A* is the horizon vane, *B* the shadow vane, *C* the sight vane, *de* is the 60 arch, containing 60 (or 65) degrees. *FG* the 30 arch, containing 30 (or 25) degrees. In using this instrument the vane *B* must be put to an even degree, less by 15° or 20° than the zenith distance, or complement of the altitude. Then turning the back to the sun, and looking through

through the vanes *C* and *A*, raise or settle the Instrument, till the shadow of the upper edge of the vane *B* fall on the slit in *A*; then raise or settle the vane *C*, till you see the horizon appear through *C* and *A*. Thus you have the sun's altitude; and adding the degrees on the arch *ed* to the degrees on the arch *FG*, gives the zenith distance.

To obtain the meridian altitude, continue observing; and as the sun rises higher, the sea will appear through the vanes, *C*, *A*; then the vane *C* is still to be moved lower, till the sun be at the highest; and when the sun begins to fall, the sky will appear through the vanes *A*, *C*; and then it is time to give over observing for that day.

But note, the refraction makes the sun or a star appear higher than he is, when near the horizon, and therefore the zenith distance must be increased (or the altitude diminish'd) according to the following table.

Altit. deg.	Refrac- tion. min.	Zenith. dist. deg.	Altit. deg.	Refrac- tion. min.	Zenith. dist. deg.
0	33	90	7	7	83
1	23	89	8	6	82
2	17	88	10	5	80
3	13	87	12	4	78
4	11	86	16	3	74
5	9	85	24	2	66
6	8	84	42	1	48

There is a late invented instrument called *Hadley's Quadrant*, for taking altitudes more exactly. But I shall not describe it here, because there is a

8 USE OF INSTRUMENTS.

FIG. little book which goes along with the Instrument; and that gives the description of it at large, and the use of the instrument in taking an observation.

4. *The Cross-Staff, or Fore-staff.*

4. This instrument is used to take the altitude of a star. It consists of a staff *AD*, and three or four crosses *BC*, to suit different altitudes. The staff *AD* being graduated on each side, in a different manner, for the different crosses.

In using it, put on the proper cross *CB*, then placing the end *A* as near the eye as possible, and turning the face to the star, move the cross *CB* back or forward, till the star appear in the upper end *C*, and the horizon at the lower end *B*; then you have the altitude number'd on the inner edge of the cross, and on that side of the staff belonging to the cross, you observe with.

For the meridian altitude; continue observing till the sea begin to appear, instead of the horizon; and then your observation is finish'd.

5. *The Lead.*

This is a heavy piece of lead, with a line fasten'd to it, divided into fathoms, to sound the depth of the sea, in shoals and places near the shoar.

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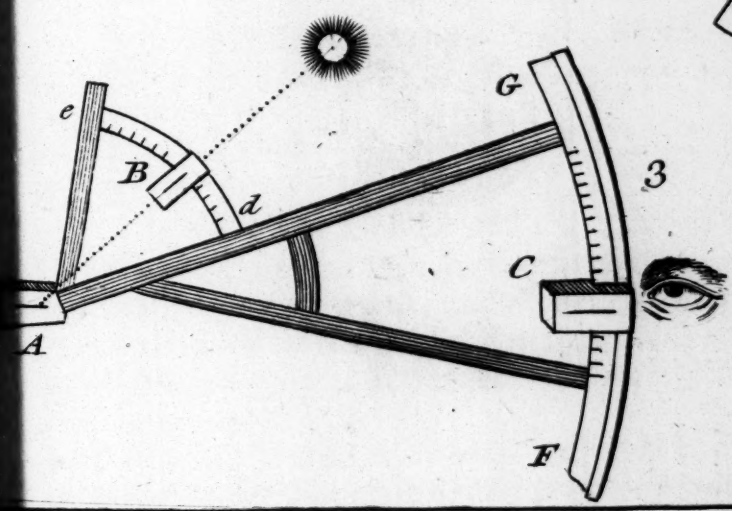
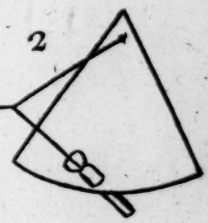
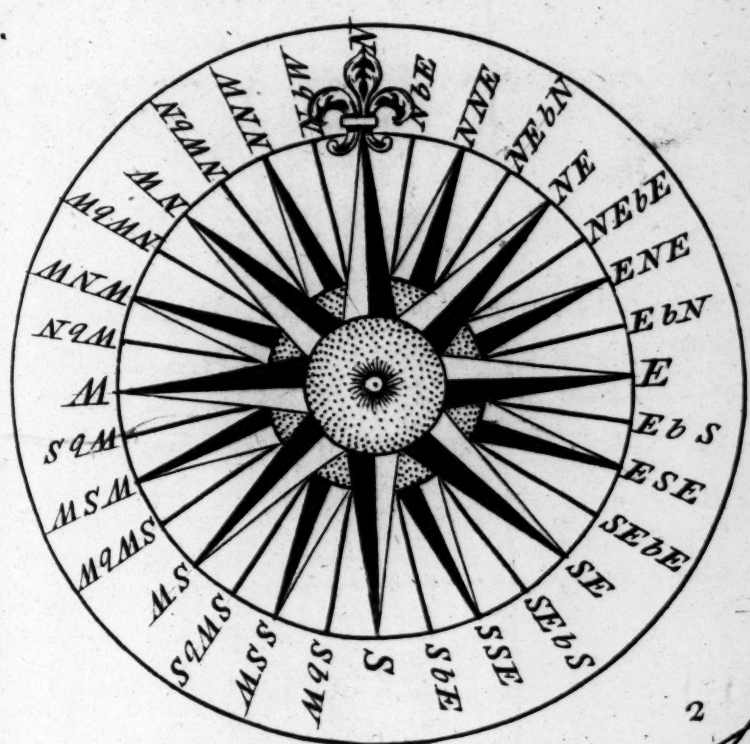
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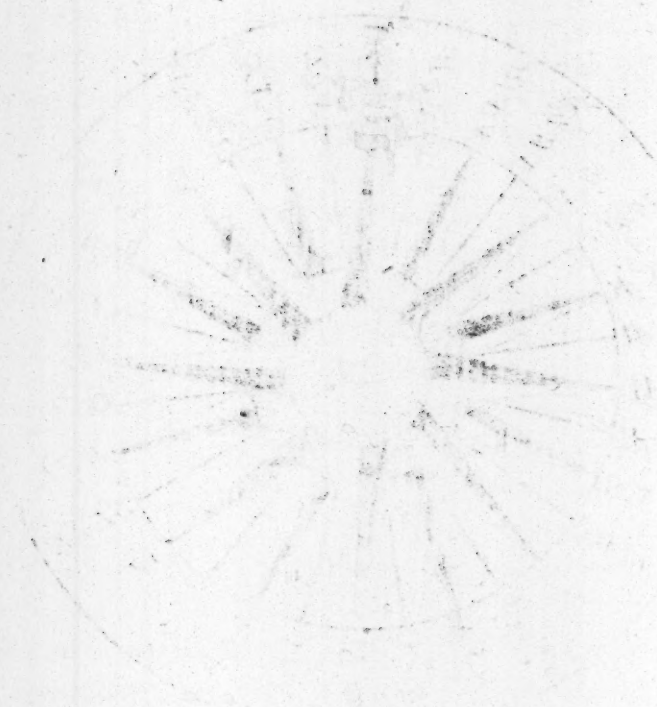
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Navigation.

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NAVIGATION.

PART I.

The Solution of Astronomical Problems, also concerning Lee Way, Variation of the Compass, taking Observation, and several other Things useful in the Art of Navigation.

To find the Moon's Age.

R U L E.

1. **D**IVIDE the year of Christ (which begins with *March*) by 19, and keep the remainder. Note, if 0 remain, take 19.

2. Multiply that remainder by 11, and divide by 30, and note this remainder.

3. To the last remainder add the number of the month, beginning at *March*: And the sum taken from 30 (or 60) gives the day of the change. Or that sum added to the day of the month, gives her age; rejecting 30 if it exceed: according to the new stile.

Note, the last remainder is the epact, and 1 added to the first remainder is the golden number. This rule seldom misses above a day.

ASTRONOMICAL

Otherwise : The moon's age is easiest and truest known by an almanack, or else by a mariner's calender, one or both of which a navigator should never want.

Example. Aug. 27th, 1766.

19)1766(92	18		
171.	11		
56	18	18 Rem.	24
38	18	6 Month.	27
18 Rem.	30)198(6	24	51
	180	30	21 Age.
	18 Rem.	6 Change.	

P R O B. II.

To find the Time of the Moon's Southing.

R U L E.

Take 8 tenths of the moon's age for her southing.

Or thus, by the Nocturnal.

In the middle piece against the moon's age, in its proper circle, stands her southing in the circle of hours.

Other

Otherwise, by seeing the Moon.

The time of the moon's southing may be nearly conjectured by observing the quantity of her enlightened side. For so many 12th parts of her whole hemisphere as is contained in her illuminated arch (on the right hand), so many hours she souths after 12 o'clock: If on the left hand, 'tis before 12.

Example.

On *Aug.* 27th, 1766, the moon is 21 days old; then,

$$\begin{array}{r} \text{mult. } 21 \\ \quad .8 \\ \hline 16.8 \end{array}$$

So she souths about 16 hours and 3 quarters past 12, that is, at 3 quarters after 4 in the morning, *Aug.* 28; and therefore at 4 o'clock, *Aug.* 27. for she loses $\frac{3}{4}$ hour at least every day.

P R O B. III.

To find the Time of High Water at a given Place.

R U L E.

By the following tide-table, find the time of full sea on the full or change day, for the place proposed; add to this the time of the moon's southing.

ASTRONOMICAL

Otherwise, by the Nocturnal.

Set 12 o'clock on the middle piece; to the time of high water at the new or full moon, on the great piece: then bring the long index to the moon's southing or age on the middle piece; this cuts the inner circle (the circle of hours) of the great piece, as required.

Example.

At the Lizard, *Aug.* 27th, 1766, it is full sea at 7:30 at the full, by the table. And the moon souths at $16\frac{3}{4}$, the sum is $24\frac{1}{4}$: that is, a quarter past 12 next day, the time of high water, or half an hour before 12, *Aug.* 27.

SCHOLIUM.

Some general observations relating to the tides, are as follow:

1. About the quarters of the moon, the tides happen something sooner, but in some places something later. Thus at *London*, these tides happen an hour sooner, and at *Dublin* half an hour later.

2. The nearer the moon comes to the zenith or nadir of any place, the greater is the tide. And therefore in north latitude, when the moon has north declination, she makes greater tides when above the horizon, and past the meridian, than when she is under the horizon. And consequently in north latitudes the evening tides are higher than the morning tides in summer; and the morning tides higher than the evening tides in winter. And the contrary in south latitudes.

3. The highest tides make the lowest ebbs.

4. The highest spring tides in the year are always about the beginning of *March*, and end of *September*;

September ; but the neap tides (or quarter tides) are least at that time, and greatest in *June* and *December*. Therefore the greatest tide at the new and full moon is always succeeded by the least at the quarters.

5. The highest monthly tides are always about the 3d day after the full or change.

6. The tides, *ceteris paribus*, are greatest under the equinoctial ; and greater in lesser latitudes than in greater latitudes.

7. Tides are greater in greater seas than in lesser seas ; and greater at the shores than in the middle of the sea, or in islands far from the continent.

8. Within the mouths of rivers the tide ebbs longer than it flows.

9. The motion of the water is greatest about half flood or half ebb ; and at high or low water is little or nothing.

10. Great winds setting the same way as the tides, will bring them sooner, and make them run higher : but if they be contrary, will retard them.

A Tide Table, shewing at what Hour it is High Water on the Full and Change of the Moon.

A		h.	m.
A BERDEEN	-	12	45
Abermorith	-	6	0
Aberwark	-	4	30
Abroth	-	3	15
Africa W. Coast	-	3	0
Aldborough	-	9	45
Amazon's R. mouth	-	6	0
Ambletense	-	11	0
America W. Coast	-	3	0
——— E. Coast	-	4	30
		Amsterdam	

A T I D E T A B L E.

			h.	m.
Amsterdam	-	-	3	0
Antwerp	-	-	6	0
Apenars	-	-	12	45
Apenmark	-	-	2	15
Archangel	-	-	6	0
Armentiers	-	-	3	0
Army	-	-	1	30
Audiern	-	-	2	15
Auray	-	-	3	45

B

Bajador	-	-	12	0
Baltimore	-	-	4	30
Barfleur	-	-	7	30
Barneville	-	-	7	0
Bass, without	-	-	3	45
Bayonne	-	-	3	30
Beachy	-	-	12	0
Beauvoir	-	-	3	15
Bell isle	-	-	3	0
Berguer	-	-	1	30
Bermudas	-	-	7	0
Berwick	-	-	2	15
Biscay Bay	-	-	3	0
Blacknefs	-	-	1	30
Blackney	-	-	6	0
Blacktail Beacon	-	-	12	15
Blanquet Race	-	-	12	0
Blavet	-	-	3	0
Bloy	-	-	4	30
Bluet, without	-	-	2	15
Bologne	-	-	11	0
Bourdeaux	-	-	6	0
Brazil Coast	-	-	4	30
Bree Sound	-	-	4	30

Bremen

PART I. A T I D E T A B L E.

15

				h.	m.
Bremen	-	-		6	0
Brest	-	-		3	30
Bridgwater	-	-	-	7	30
Bridlington	-	-	-	4	0
Brill	-	-	-	1	30
Bristol	-	-	-	6	30
— Key	-	-	-	6	45
Brovage, without	-	-	-	3	45
Buchanefs	-	-	-	3	0
Bulloign	-	-	-	10	30
Buoy o' Nore	-	-	-	1	15

C

Caen	-	-	-	9	0
Caldy	-	-	-	5	15
Calais	-	-	-	11	30
Calshot	-	-	-	11	15
Camfere	-	-	-	1	30
Canary Islands	-	-	-	3	0
Cancale	-	-	-	6	0
Cape Blanco	-	-	-	9	45
— Cantin	-	-	-	12	0
— Clear	-	-	-	4	30
— de Four	-	-	-	2	45
— of Good Hope	-	-	-	3	0
— Sierre Lion	-	-	-	8	15
Carmarthen Bay	-	-	-	5	15
Carnarvon Bay	-	-	-	5	15
Caskets	-	-	-	9	45
Caskets without	-	-	-	8	15
Catnefs	-	-	-	9	0
Chambernefs	-	-	-	9	45
Cherburg	-	-	-	7	30
Chili Coast	-	-	-	3	0
Concarneau	-	-	-	3	0
				Condado	

A T I D E T A B L E.

			h.	m.
Condado	-	-	12	0
Conquet	-	-	3	0
Cork	-	-	6	0
Corpus Christi Point	-	-	1	30
Cowes	-	-	10	30
Creyl	-	-	11	15
Croific	-	-	3	0
Cromer	-	-	7	0

D

Dartmouth	—		6	0
Deal	—	—	10	30
Derby	—	—	2	15
Defire Port	—	—	12	0
Dieppe	—	—	10	30
Dort	—	—	3	0
Dover	—	—	10	30
Dover Port	—	—	12	0
Downs	—	—	1	15
Dublin Bar	—	—	10	0
— Custom-house	—	—	11	0
Dunbar	—	—	2	0
Dundee	—	—	2	15
Dungarven	—	—	4	30
Dungeness	—	—	9	45
Dunkirk	—	—	12	0
Dunnose	—	—	9	45
Dunwich	—	—	9	45

E

Edam	—	—	1	30
Edinburgh	—	—	4	30
Egmon	—	—	4	30
Eider	—	—	12	0
				<u>Elve</u>

		h.	m.
Elve	— — —	12	0
Embden	— — —	12	0
Emes	— — —	9	0
Emes Entrance	— — —	7	30
Enchuyfen	— — —	12	0
Engomonts	— — —	9	0
Eftaple	— — —	11	0
Exwater	— — —	7	30

F

Fair I.	— — —	12	0
Fair I. Roads	— — —	11	15
Falmouth	— — —	5	30
Fen	— — —	1	30
Fescan	— — —	9	45
Finmark Coast	— — —	1	30
Firth	— — —	11	0
Flamborough Head	— — —	4	0
Flanders Banks	— — —	1	0
Florida	— — —	7	30
Flushing	— — —	0	45
<i>The Fly</i>	— — —	7	30
Foreland, N. and S.	— — —	9	45
Forn	— — —	5	15
Foulness	— — —	6	45
Fontenay Race	— — —	2	15
Foy	— — —	5	15
France, W. Coast	— — —	3	0
Friesland Coast	— — —	7	30

G

Galicia	— — —	3	0
Garande	— — —	3	0
Garonne Mouth	— — —	3	0
		Gascoign	

A T I D E T A B L E.

		h.	m.
Gascoin	_____	3	0
Gibraltar Road	_____	12	0
Goree	_____	1	30
Gorend	_____	11	15
Granville	_____	7	0
Graveling	_____	12	0
Gravesend	_____	1	30
Groyn	_____	3	0
Guernsey	_____	1	30
Gunfleet	_____	10	30

H

Hague	_____	8	15
Hamborough	_____	6	0
Hampton Key	_____	12	0
Harlem	_____	9	0
Hartlepool	_____	3	0
Harwich	_____	11	0
Hastings	_____	10	30
Havre de Grace	_____	9	0
Hern	_____	12	0
Hever	_____	12	0
Holms	_____	6	0
Holy-Head	_____	1	30
Home-Head	_____	9	0
Honfleur	_____	9	0
Horn	_____	1	30
Hull	_____	6	0
Humber Mouth	_____	5	15
Hunclif Foot	_____	3	45

I

John de Luce	_____	10	30
Ireland S. Coast	_____	5	15
Ireland W. Coast	_____	3	0
Jutland			

PART I. A T I D E T A B L E.

19

		h.	m.
Jutland If.	—	12	0

K.

Kentish Knock	—	12	0
Kildive	—	9	0
Kilduyn ^a	— —	7	30
Killiars	—	3	0
Kingfale	— —	5	15

L

Lambay	—	8	15
Land's End	—	7	30
Lanion	— —	6	45
Lawreness	—	4	30
Leith	— —	4	0
Lenow	—	9	45
Leystof	— —	9	45
Leystof Road	—	10	30
Lime	— —	7	0
Lisbon	— —	2	15
Lizard	— —	7	30
London	— —	3	0
Longsand Head	—	10	30
Loyr Mouth	—	3	0
Lundey	—	5	15
Lyn	— —	6	0
Lyn, without	—	5	15

M

Mackwell's Castle	—	8	15
Maes	—	3	45
Magnes Sound	—	8	15
Malden	—	12	45

Man

A T I D E T A B L E.

		h.	m.
Man I.	— —	9	0
Margate Road	—	11	15
Memiflan	— —	3	30
Meuse Mouth	— —	1	30
Milford	— —	5	45
— Haven	—	7	30
Moonlefs	— —	5	15
Morbihan	— —	3	0
Mounts Bay	— —	4	30
Moufehole	— —	4	30

N

Nantz River	— —	3	0
Naze	— —	11	15
Needles	— —	9	0
Newcastle	— —	5	15
Newport (I. Wight)	— —	12	0
Nore	— —	12	0
Normandy Coaft	— —	10	30

O

Ollonne	— —	3	15
Orfordnefs	— —	10	0
Orkneys	— —	6	0
Orwell	— —	9	0
Oftend	— —	12	0

P

Penmark	— —	2	15
Pens	— —	3	0
Peru Coaft	— —	3	0
Peterport	— —	8	15
Picardy Coaft	— —	10	30
Plymouth			

PART I. A T I D E T A B L E.

25

		h.	m.
Plymouth	— — —	6	0
Podefemsk (Ruffia)	— — —	6	45
Poictou S. Coast	— — —	3	0
Port Blank	— — —	4	30
Porthus	— — —	3	0
Portland	— — —	8	15
Portugal Coast	— — —	3	45
Portsmouth	— — —	11	30

Q

Quebeck (Canada)	— — —	6	0
Quinborough	— — —	12	0

R

Ramkins	— — —	1	30
Ramsey	— — —	5	15
Rebdan	— — —	12	45
Rhee I.	— — —	3	0
Rhodes	— — —	11	15
Robinhood's Bay	— — —	3	0
Rochelle	— — —	3	45
Rocheſter	— — —	12	45
Rochfort	— — —	4	15
Rohan	— — —	3	45
Rotterdam	— — —	3	0
Roven	— — —	1	0
Rumney	— — —	1	30
Rye	— — —	11	15

S

Saint Andrews	— — —	2	15
— — — Augustine (Florida)	— — —	7	30
— — — David's Head	— — —	6	0
		Saint	

A T I D E T A B L E.

	h.	m.
Saint Helen's	10	30
— John de Luz	3	30
— Lucas	2	15
— Malo's	5	30
— Mark	2	15
— Matthew's Point	3	45
— Nicholas (Ruffia)	6	45
— Paul de Leon	4	0
— Powls	6	0
— Valleri	9	45
Salcomb	6	0
Sandwich	11	30
Scarborough	3	45
Scily Islands	3	45
Sedmouth	6	45
Senegal	10	30
Seven Clifts	9	0
Seven Isles	4	30
Severn Isles	4	30
Severn Mouth	5	45
Seyn Mouth	9	0
Sheerness	12	0
Shelbergh	9	0
Shetland	3	0
Shoe	12	0
Shoram	9	45
Sleeve	12	0
Somme Mouth	11	0
Sound	3	45
Southampton	12	0
Spain W. Coast	3	0
Spits	12	0
Spurn	5	15
Staples	3	45
Start	6	45
Stockton	5	15
		Swin

PART I. A TIDE TABLE.

23

		h.	m.
Swin	—	12	0

T

Tees Mouth	—	3	0
Tenerif	—	3	0
Tenet	—	1	30
Terveer, within	—	12	45
Terveer without	—	1	30
Tergon	—	9	45
Texel Road	—	7	0
Texel Cliffs	—	5	0
Thames Mouth	—	1	0
Tinmouth	—	3	0
Topsham	—	6	0
Torbay	—	6	0
Treport	—	10	30

U

Vannes	—	3	45
Voord	—	4	30
Urek	—	12	0
Use	—	3	0
Ushant within	—	4	30

W

Wales	—	5	15
Wash (Lincolnf.)	—	6	30
Waterford	—	6	15
Weilands	—	1	30
Wells	—	6	0
Weymouth	—	7	15
Key	—	6	45
Whitby	—	3	0
Wieringham			

ASTRONOMICAL

		h.	m.
Wieringham	—	7	0
Wight I.	—	9	30
Winchelsea		12	45
Winterton	—	8	0

Y

Yarm	—	6	45
Yarmouth	—	10	0
— Roads	—	10	30
Younghall (Ireland)	—	5	0

Z

Zeland Coast	—	1	30
Zerick Sea	—	3	0

P R O B. IV.

The Latitude of the Place, and the Sun's Declination given; to find his Amplitude.

R U L E.

As cosine lat.

Radius.

Sine of the declination.

Sine of the amplitude.

The amplitude is south if the declination be south, and north, if north.

Note, The declination is had by the Table, after Prop. 13.

P R O B.

PART I. PROBLEMS.

PROB. V.

*The Declination, Altitude, and Azimuth of the Sun
being given; to find the Hour.*

RULE.

As cof. declination.

Cof. altitude.

Sine azimuth.

Sine of the hour angle.

This turned into time, allowing 15 deg. to an hour, gives the distance of time from noon or midnight; for it is doubtful sometimes whether it is.

PROB. VI.

*Given the Latitude and Sun's Declination; to find
the Time of Sun-Rising.*

RULE.

As radius,

Tan. latitude,

Tan. declination,

Sine ascensional difference.

This turned into time, allowing 15 deg. to an hour, will show how long the sun rises before 6, when his declination is towards the elevated pole; but after 6, when his declination is the contrary way.

PROB. VII.

*Given the Sun's Declination and Amplitude; to find
the Latitude.*

RULE.

As Sine Amplitude,

Radius,

Sine Declination,

Cof. Latitude.

C

PROB.

P R O B. VIII.

Given the Sun's Rising and Declination ; to find Latitude.

Find how long the sun rises before or after and turn this time into degrees, allowing for every hour 15 deg. and four minutes of time for one degree ; call this the ascensional difference ; then

R U L E.

As radius,
Cotan. declination,
Sine ascensional difference,
Tan. latitude.

If the sun rises before 6, the declination is towards the elevated pole : If after 6, the declination is towards the depressed pole.

P R O B. IX.

Given the Declination and Meridian Altitude of Sun or a known Star ; to find the Latitude. Or work an Observation.

R U L E.

Take the altitude of the sun or star with quadrant, and subtract it from 90 ; and the mainder is the zenith distance. Also find the declination in the table after Prop. 13.

5. Describe the semicircle *SZN* for the meridian *SN* the horizon, *S* the south point, *N* the north point, bisect *SZN* in *Z* for the zenith. Then if the observed altitude be south, set the zenith distance

from Z towards S ; (but if north, towards N), FIG. 5.
let it be at $*$.

Then if the declination be north, set it from $*$ towards S , (but if south, towards N), suppose to E . Then is EZ the latitude, which is north, when Z is between E and N ; but south, if Z is between E and S ; and EC will be the equinoctial.

Note, If the sun or star happens to be under the pole; use the supplement of the declination, and set it the contrary way.

And thus a figure may be drawn by hand, to shew when you are to add the declination and zenith distance together, or when to subtract the one from the other, for finding the latitude.

In short, thus :

Having duly remarked what name the declination is of, north or south; and also which way the object, whether it be sun or star, bears from you; then,

1. If the declination and bearing be of a contrary name or kind; add the declination to the zenith distance, for the latitude, which is of the same name as the declination.

2. Declination and bearing, both of a name, and declination greater; subtract the zenith distance from the declination, for the latitude, of the same name.

3. Declination and bearing, both of a name, and zenith distance greater; subtract the declination from the zenith distance; for the latitude, of a contrary name.

But note, If the object be under the pole, subtract the zenith distance from the supplement of declination, for the latitude, of the same name.

FIG.

P R O B. X.

Given the Altitude, Declination, and Azimuth of the Sun, or a known fixt Star; to find the Latitude.

The azimuth is reckoned from the north.
Subtract the altitude from 90, the remainder is the zenith distance: then,

R U L E.

As radius,
Cof. azimuth,
Tan. zenith distance,
Tan. an arch A .

And sine altitude,
Sine declination,
Cof. arch A ,
Cof. arch B .

Then the difference of the archs A and B subtracted from 90 gives the latitude.

Note, If the observation be made between 6 and 6 in the day; and at the same time the azimuth is less than 90; then you must subtract the sum of the archs A and B from 90.

P R O B. XI.

The Latitude of two Places, and their Difference of Longitude being given; to find the Angles of Position; or the bearing of one Place from another, in the Arch of a great Circle.

R U L E.

6. Let A, D be the two places; find the distances of the two places from one and the same pole, as
the

the north pole P , and add these two polar distances together, and subtract them from one another, to find their sum and difference; then say,

As Cosine of $\frac{1}{2}$ sum,
Cos. $\frac{1}{2}$ difference,
Cotan. $\frac{1}{2}$ difference of longitude,
Tan. of an arch B .

Where note, if $\frac{1}{2}$ sum be greater than 90° , B is greater than 90° , otherwise less. *Again,*

As sine of $\frac{1}{2}$ sum,
Sine of $\frac{1}{2}$ difference,
Cotan. $\frac{1}{2}$ difference of longitude,
Tan. of an arch C .

Then the sum of the arches B and C is the angle of position at the place of greater latitude, or nearest the pole. And the difference of B and C is the angle at the place of lesser latitude, or furthest from the pole.

S C H O L.

Upon this prop. great circle-sailing depends. If the places be far distant from one another, there will be a considerable difference between the angle of position, and the course or bearing upon the rumb; and likewise in the distance: a great circle being the nearest distance between any two places. But it is very difficult for a ship to sail exactly upon the arch of a great circle; because she must be continually altering her course; and to know exactly the course every moment, it must be computed for all points of the arch, which will give more trouble than advantage. Yet if any have a mind to keep near a great circle in sailing from one place

FIG. place to another, as from A to D ; he must proceed thus, first let him compute the angle of position at A , which is the course he must steer at first. Then after sailing some distance upon this course as 60 or 70 leagues, let him compute the place of the ship, as at e . Then there will be given the lat. and diff. longitude of the two places e , D (as before of A , D): Then compute again the angle of position at e , by this prop. as before; and this is the course to steer from e . And so on from one place to another.

P R O B. XII.

To find the Time of the Southing of a given Star, on a given Day.

R U L E.

In the following tables, find the right ascension of the sun for the time given, and likewise the right ascension of the star; and subtract the right ascension of the sun from the star's right ascension adding 24 hours if the stars be less; then the remainder is the time of the star's southing, from noon.

Or, subtract the star's right ascension from the sun's, gives the distance of time before noon.

Example.

To find when *Syrius* or the great Dog south
Feb. 20th, 1764. London. N. S.

Rig

		h.	m.
Right Ascension of Sirius		6	35
Add	24	0	
		30	35
Sun's right ascension <i>Feb.</i> 19th (leap-year)	22	14	
The Hour	-	8	21

PROB. XIII.

To find what Star souths at a given Hour of a given Day.

RULE.

Find the sun's right ascension for the day, in the following table of the sun's right ascension.; to this add the given hour, counted forward from noon. Look for the sum, or the nearest to it, in the following table of the star's right ascension; and against it you will find the star sought.

Note, If the sum exceed 24, reject 24.

Example.

What star souths at 3 o'clock in the morning on *Oct.* 13th, 1767, London.

		h.	m.
Time given, <i>Oct.</i> 12th.		15	0
Sun's right ascension	-	13	12
Sum.	28	12	
		24	
or,	4	12	

A T A B L E.

h. m. h. m.

The nearest to 4 : 12 is 4 : 22. So *Aldebaran* is the star required.

A T A B L E.

Of the Sun's right Ascension in Time, and his Declination, every Day at Noon; to the Meridian of *Greenwich* near *London*.

To find the Sun's right Ascension or Declination to a given Time.

R U L E.

1. Find the month on the top of the page, and the day on the side; then over-against the day, in the proper column of the month, is the right ascension or declination. *But note,*

2. In leap-year, reckon for a day less in *January* and *February*.

3. For the 1st, 2d, or 3d year after leap-year, reckon for $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ of a day sooner.

4. Also for every 15 deg. E. longitude from *Greenwich*, reckon for an hour sooner: and later for W. longitude. Also make allowance for any time after noon.

N. B. Leap-year is known by dividing the year of our Lord by 4; the remainder shews the number of the year.

Examples.

1. According to these directions, the sun's right ascension, *May* 14th, 1764 (being leap-year) at noon is 3 h. 27 m. And at 6 o'clock at night is 3 h. 28 m.

And

PART I. A T A B L E.

33

And for *Aug.* 10, 1762 (the 2d after leap-year) his right ascension at noon is 9 h. 21 m. and at 6 in the morn. is 9 h. 20 m.

2. The sun's declination, *Jan.* 28, 1764 (or leap-year), at noon is $18^{\circ} 15' S.$ And *Oct.* 22d, 1765 (the 1st after leap-year), at noon it is $11^{\circ} 15' S.$ and at midnight it is $11^{\circ} 26' S.$

C 5

SUN's

SUN'S RIGHT ASCENSION

Days.	January.				February.				March.			
	R. Asc.		Dec.		R. Asc.		Dec.		R. Asc.		Dec.	
	H.	M.	D.	M.	H.	M.	D.	M.	H.	M.	D.	M.
1	18	51	22	S. 58	21	3	16	S. 52	22	52	7	S. 16
2	18	55	22	52	21	7	16	35	22	55	6	54
3	19	00	22	46	21	11	16	17	22	59	6	30
4	19	04	22	40	21	15	15	59	23	3	6	7
5	19	9	22	33	21	19	15	41	23	7	5	44
6	19	13	22	26	21	23	15	24	23	10	5	21
7	19	17	22	18	21	27	15	3	23	14	4	58
8	19	22	22	9	21	31	14	44	23	18	4	34
9	19	26	22	1	21	35	14	25	23	21	4	11
10	19	30	21	52	21	39	14	5	23	25	3	47
11	19	35	21	42	21	43	13	45	23	29	3	24
12	19	39	21	32	21	47	13	25	23	32	3	0
13	19	43	21	22	21	51	13	5	23	36	2	36
14	19	48	21	11	21	55	12	45	23	40	2	13
15	19	52	21	0	21	58	12	24	23	43	1	49
16	19	56	20	48	22	2	12	3	23	47	1	25
17	20	0	20	36	22	6	11	42	23	51	1	1
18	20	5	20	24	22	10	11	20	23	54	0	38
19	20	9	20	11	22	14	10	59	23	58	0	14
20	20	13	19	58	22	18	10	38	0	1	0	N. 9
21	20	17	19	44	22	22	10	16	0	5	0	33
22	20	22	19	30	22	25	9	54	0	9	0	57
23	20	26	19	16	22	29	9	32	0	12	1	20
24	20	30	19	1	22	33	9	9	0	16	1	44
25	20	34	18	46	22	37	8	47	0	20	2	7
26	20	38	18	31	22	40	8	25	0	23	2	31
27	20	42	18	15	22	44	8	2	0	27	2	54
28	20	47	17	59	22	48	7	39	0	31	3	18
29	20	51	17	43					0	34	3	41
30	20	55	17	27					0	38	4	4
31	20	59	17	10					0	41	4	28

PART I. *and* DECLINATION.

35

Days.	April.				May.				June.			
	R. Asc.		Dec.		R. Asc.		Dec.		R. Asc.		Dec.	
	H.	M.	D.	M.	H.	M.	D.	M.	H.	M.	D.	M.
1	0	45	4	N.51	2	36	15	N.19	4	39	22	N.11
2	0	49	5	14	2	40	15	37	4	43	22	19
3	0	52	5	37	2	44	15	54	4	47	22	26
4	0	56	5	59	2	48	16	11	4	51	22	33
5	1	0	6	22	2	52	16	29	4	56	22	39
6	1	3	6	45	2	56	16	45	5	0	22	45
7	1	7	7	7	2	59	17	2	5	4	22	51
8	1	11	7	30	3	3	17	18	5	8	22	56
9	1	14	7	52	3	7	17	34	5	12	23	1
10	1	18	8	14	3	11	17	50	5	16	23	6
11	1	22	8	36	3	15	18	5	5	20	23	10
12	1	25	8	58	3	19	18	20	5	24	23	14
13	1	29	9	20	3	23	18	35	5	29	23	17
14	1	33	9	41	3	27	18	49	5	33	23	20
15	1	36	10	3	3	31	19	4	5	37	23	23
16	1	40	10	24	3	35	19	17	5	41	23	25
17	1	4	10	45	3	39	19	31	5	45	23	26
18	1	47	11	6	3	43	19	44	5	49	23	28
19	1	51	11	27	3	47	19	57	5	54	23	29
20	1	55	11	47	3	51	20	9	5	58	23	29
21	1	59	12	7	3	55	20	21	6	2	23	29
22	2	2	12	27	3	59	20	33	6	6	23	29
23	2	6	12	47	4	3	20	44	6	10	23	28
24	2	10	13	7	4	7	20	55	6	14	23	27
25	2	14	13	26	4	11	21	6	6	19	23	25
26	2	17	13	46	4	15	21	16	6	23	23	23
27	2	21	14	5	4	19	21	26	6	27	23	21
28	2	25	14	24	4	23	21	36	6	31	23	18
29	2	29	14	42	4	27	21	45	6	35	23	14
30	2	33	15	1	4	31	21	54	6	39	23	11
31					4	35	22	31				

SUN'S RIGHT ASCENSION,

Days.	July.				August.				September.			
	R. Asc.		Dec.		R. Asc.		Dec.		R. Asc.		Dec.	
	H. M.	D. M.	H. M.	D. M.	H. M.	D. M.	H. M.	D. M.	H. M.	D. M.	H. M.	D. M.
1	6	43	23	N.7	8	48	17	N.54	10	44	8	N.3
2	6	48	23	2	8	52	17	38	10	48	7	41
3	6	52	22	57	8	56	17	23	10	51	7	19
4	6	56	22	52	9	0	17	7	10	55	6	57
5	7	0	22	46	9	4	16	50	10	59	6	35
6	7	4	22	40	9	7	16	34	11	2	6	12
7	7	8	22	34	9	11	16	17	11	6	5	50
8	7	12	22	27	9	15	16	0	11	9	5	27
9	7	16	22	20	9	19	15	42	11	13	5	4
10	7	20	22	12	9	23	15	25	11	17	4	42
11	7	25	22	4	9	26	15	7	11	20	4	19
12	7	29	21	55	9	30	14	49	11	24	3	56
13	7	33	21	47	9	34	14	31	11	27	3	33
14	7	37	21	38	9	38	14	12	11	31	3	10
15	7	41	21	28	9	41	13	53	11	35	2	46
16	7	45	21	18	9	45	13	34	11	38	2	23
17	7	49	21	8	9	49	13	15	11	42	2	0
18	7	53	20	57	9	53	12	55	11	45	1	36
19	7	57	20	4	9	56	12	35	11	49	1	13
20	8	1	20	35	10	0	12	16	11	52	0	50
21	8	5	20	23	10	4	11	55	11	56	0	26
22	8	9	20	11	10	8	11	35	12	0	0	3
23	8	13	19	59	10	11	11	15	12	3	0	S.21
24	8	17	19	46	10	15	10	54	12	7	0	44
25	8	21	19	33	10	19	10	33	12	11	1	8
26	8	25	19	20	0	22	10	12	12	14	1	31
27	8	29	10	7	10	26	9	51	12	18	1	55
28	8	33	18	53	10	30	9	30	12	21	2	18
29	8	36	18	38	10	33	9	9	12	25	2	41
30	8	40	18	24	10	37	8	47	12	29	3	5
31	8	44	18	9	10	40	8	25				

	Days	October.		November.		December.	
		R. Asc. H. M.	☉ Dec. D. M.	R. Asc. H. M.	☉ Dec. D. M.	R. Asc. H. M.	☉ Dec. D. M.
3	1	12 32	3 S. 28	14 29	14 S. 42	16 33	21 S. 58
41	2	12 36	3 51	14 33	15 1	16 37	22 7
19	3	12 39	4 15	14 37	15 20	16 42	22 16
57	4	12 43	4 38	14 41	15 39	16 46	22 24
35	5	12 47	5 1	14 45	15 57	16 50	22 31
12	6	12 50	5 24	14 49	16 15	16 55	22 38
50	7	12 54	5 47	14 53	16 33	16 59	22 45
27	8	12 58	6 10	14 57	16 50	17 4	22 51
4	9	13 1	6 33	15 1	17 7	17 8	22 57
42	10	13 5	6 56	15 5	17 24	17 12	23 2
19	11	13 9	7 19	15 9	17 41	17 17	23 7
56	12	13 13	7 41	15 13	17 57	17 21	23 11
33	13	13 16	8 4	15 17	18 13	17 26	23 15
10	14	13 20	8 26	15 21	18 28	17 30	23 18
46	15	13 24	8 49	15 25	18 44	17 34	23 21
23	16	13 27	9 11	15 29	18 58	17 39	23 24
0	17	13 31	9 33	15 33	19 13	17 43	23 26
36	18	13 35	9 55	15 38	19 27	17 48	23 27
13	19	13 39	10 16	15 42	19 41	17 52	23 28
50	20	13 42	10 38	15 46	19 55	17 57	23 29
26	21	13 46	10 59	15 50	20 8	18 1	23 29
3	22	13 50	11 20	15 54	20 21	18 6	23 29
21	23	13 54	11 42	15 59	20 33	18 10	23 28
44	24	13 58	12 2	16 3	20 45	18 14	23 26
8	25	14 2	12 23	16 7	20 57	18 19	23 24
31	26	14 5	12 44	16 11	21 8	18 23	23 22
55	27	14 9	13 4	16 16	21 19	18 28	23 20
18	28	14 13	13 24	16 20	21 29	18 32	23 17
41	29	14 17	13 44	16 24	21 40	18 37	23 13
5	30	14 21	14 4	16 29	21 49	18 41	23 9
	31	14 25	14 23			18 45	23 4

ASTRONOMICAL

A TABLE of the right Ascension in Time, and of the Declination and Magnitude of the principal Stars, for the Year 1764, and forward.

STARS.	Right Ascen.		Declination.		Magn.
	h.	m.	d.	m.	
Whale's southern tail -	0	32	19	17 S.	2
Cassiopeia's hip -	0	42	59	26 N.	2
Pole star -	0	45	88	4 N.	2
Last in Eridanus, <i>Acarnar.</i>	1	29	58	26 S.	1
Bright star of Aries -	1	54	22	20 N.	2
Whale's jaw, <i>Cetus</i> -	2	50	3	9 N.	2
Brightest of the 7 stars -	3	34	23	21 N.	3
Bull's eye, <i>Aldebaran</i> -	4	22	16	1 N.	1
The Goat, <i>Capella</i> -	4	59	45	44 N.	1
Orion's foot, <i>Rigel.</i> -	5	1	8	29 S.	1
Middle of Orion's belt -	5	24	1	22 S.	2
Orion's right shoulder, <i>Bel-</i> <i>telgeus</i> -	5	42	7	21 N.	1
Ship's rudder, <i>Canopus</i> -	6	19	52	35 S.	1
Great dog, <i>Sirius</i> -	6	35	16	24 S.	1
Northern twin, <i>Castor</i> -	7	19	32	23 N.	2
Little dog, <i>Procyon</i> -	7	27	5	49 N.	1
Southern twin, <i>Pollux</i> -	7	31	28	35 N.	2
Hydra's heart, <i>Alphard.</i> -	9	16	7	38 S.	2
Lion's heart, <i>Regulus</i> -	9	55	13	6 N.	1
Lower pointer -	10	46	57	39 N.	2
Upper pointer -	10	48	63	1 N.	2
Lion's tail -	11	37	15	53 N.	2
Foot of the crossiers -	12	14	61	47 S.	1
Great bear's rump, <i>Allioth,</i>	12	43	57	14 N.	2
Virgin's spike, <i>Azimech</i> -	13	12	9	55 S.	1
Last in great bear's tail, <i>Be-</i> <i>netnaseh.</i> -	13	38	50	30 N.	2
<i>Arcturus</i> -	14	5	20	25 N.	1

Centaur's

STARS.	Right Ascen.		Declina- tion.		Magn.
	h.	m.	d.	m.	
Centaur's fore foot -	14	24	59	51 S.	1
Little Bear - -	14	50	75	7 N.	2
Northern crown, <i>Ariadne</i>	15	25	27	32 N.	2
Scorpion's heart, <i>Antares</i>	16	15	25	53 S.	1
The harp, <i>Lyra</i> -	18	29	38	35 N.	1
Eagle or vulture's heart, <i>Aquila</i>	19	39	8	15 N.	2
Swan's tail, <i>Deneb</i> . -	20	33	44	27 N.	2
Southern fish, <i>Fomelhaut</i> -	22	44	30	52 S.	1
Pegasus's wing, <i>Marcab</i> -	22	53	13	56 N.	2
Andromeda's head, <i>Alpheratz</i>	23	56	27	47 N.	2

P R O B. XIV.

To calculate the Eclipses of the first Satellite of Jupiter; for the Meridian of London.

1. Out of Tab. I. take the time for the year, month and day, &c. next less than the day proposed; and also the correspondent numbers A and B; and add them all up in separate columns. Thus you have the mean time of the middle of the eclipse.

2. Out of Tab. II. with number A, take the equation of number B, to be added to B. Take also another small equation for B out of Tab. III. for the day of the month, to be added to B likewise: then call this numb. C. *Also,*

3. From Tab. II. with number A. take out the 1st equation, and with number C, the 2d equation; and then add these equations and the mean time together; and you have the true equated time of the middle of the eclipse.

4. From Tab. II. with num. A. take out the semiduration; and if number C be less than 500, subtract the semiduration, and you will have the mean time of the *beginning* or *immersion*: But if more than

than 500, add it; and you have the mean time of *emerſion*, or *end* of the eclipse.

5. Laſtly, out of Tab. III. take the equation of time, for the day, and add or ſubtract as the table directs; and you have the apparent time reckoned from noon.

N. B. In leap-year after *February*, one day is to be deducted from the day of the month. Alſo if the eclipse happens in the day-time, add one revolution 1 d. 18 h. 28 m. 36 ſ, gives the time of the next eclipse. When the numbers A or B exceed 1000, reject 1000. When the numbers cannot be found exactly in the tables, you muſt take a proportional part of the difference, as is uſual.

This ſatellite never goes ſo far as $2\frac{1}{2}$ of Jupiter's diameters, from his body; and it ſtays about $\frac{3}{4}$ of a minute in the penumbra, where it gradually appears or diſappears.

Example I.

To find the Time of the Eclipse, Jan. 12th, 1766.

	d.	h.	m.	ſ.	N. A.	N. B.
1766.	0	12	20	49	830	403
January.	12	9	20	12	3	32
Mean time	12	21	41	1	833	435
1 Equa.		1	14	39		3
2 Equa.				38		
Cor. time	12	22	56	18		438
Semidur.	—	1	8	27		C
Equat. t.	12	21	47	51		
	—		9	12		
	12	21	38	39	Immersion,	

PART I. PROBLEMS.

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So the beginning of the eclipse happens *January*
 12th, at 21 h. 38 m. 39 f. afternoon; or on *Jan.*
 13th, at 9 h. 38 m. 39 f. in the morning; but
 because this happens in the day-time,

to	12	21	38	39
add	1	18	28	36

	14	16	7	15
--	----	----	---	----

Therefore the eclipse begins *Jan. 15*, at 4 h.
 7 m. 15 f. in the morning.

Example

Example II.

To find the Time of the Eclipse, Apr. 4th, 1764.

	d.	h.	m.	f.	A	B
1764.	0	13	29	18	662	570
Apr.	0	6	18	34	21	226
Day.	3	12	57	12	1	9
Mean time	4	8	45	4	684	805
Leap-year	3	8	45	4		1
1 Equa.		1	16	51		4
2 Equa.			10	8		810
						C
Semidur.	3	10	12	3		
	+	1	6	1		
Eq. time	3	11	18	4		
		—	3	21		
	3	11	14	43	Emerfion.	

So the eclipse ends near 11 h. 15 m. on Apr. 3d.

T A B. I.

Years current.	The Time.				Numb. A.	Numb. B.
	D.	H.	M.	S.		
1760	0	10	14	50	325	909
1761	0	0	26	19	410	823
62	1	9	6	23	494	741
63	0	23	17	50	578	655
64	0	13	29	18	662	570
65	0	22	9	21	746	488
66	0	12	20	49	830	403
67	0	2	32	16	915	317
68	1	11	12	20	999	235
69	0	1	23	47	83	149
70	1	10	3	51	168	68
71	1	0	15	18	252	982
72	0	14	26	46	336	896
73	0	23	6	50	420	814
74	0	13	18	18	505	728
75	0	3	29	45	589	643
76	1	12	9	49	673	561
77	0	2	21	15	758	475
78	1	11	1	18	842	393
79	1	1	12	45	926	307
80	0	15	24	14	10	222
81	1	0	4	15	94	140
82	0	14	15	42	179	54
83	0	4	27	9	263	968
84	1	13	7	13	347	887
85	1	3	18	40	432	801
86	1	11	58	42	516	719
87	1	2	10	8	600	633
88	0	16	21	37	685	547
89	1	1	1	38	769	466
1790	0	15	13	5	853	380

T A B.

ASTRONOMICAL TABLES.

T A B. I.

Years current.	The Time.				Numb.	Numb.
	D.	H.	M.	S.	A.	B.
1791	0	5	24	31	938	294
92	1	14	4	35	22	212
93	0	4	16	21	106	126
94	1	12	56	3	191	45
95	1	3	7	29	275	959
96	0	17	18	58	359	873
97	1	1	58	59	444	791
98	1	16	10	26	528	705
99	0	6	21	52	612	619
1800	1	15	1	56	697	538
1	1	5	13	22	781	452
2	0	19	24	49	865	366
3	0	9	36	15	950	280
4	1	18	16	17	34	199
5	0	8	27	44	118	113
6	1	17	7	46	203	31
7	1	7	19	13	287	945
8	0	21	30	39	371	864
9	0	6	10	43	455	778
1810	1	14	50	47	540	692

T A B.

T A B. I.

Months.	The Time.				Numb.	
	D.	H.	M.	S.	A.	B.
January.	0	0	0	0	0	0
February.	0	20	34	47	7	82
March.	1	4	12	23	14	152
April.	0	6	18	34	21	226
May.	0	8	24	45	28	300
June.	1	4	59	32	35	377
July.	1	7	5	44	42	450
August.	0	9	11	55	49	524
September.	1	5	46	42	56	603
October.	1	7	52	54	63	679
November.	0	9	59	5	70	758
December.	0	12	5	16	77	836
Days,	0	0	0	0	0	0
Hours,	1	18	28	36	0	5
&c.	3	12	57	12	1	9
	5	7	25	48	1	14
	7	1	54	24	2	18
	8	20	23	0	2	23
	10	14	51	36	2	27
	12	9	20	12	3	32
	14	3	48	48	3	37
	15	22	17	24	4	41
	17	16	46	0	4	46
	19	11	14	36	4	51
	21	5	43	12	5	55
	23	0	11	47	5	60
	24	18	40	23	6	64
	26	13	8	59	6	69
	28	7	37	35	7	73
	30	2	6	11	7	78
	31	20	34	47	7	82

T A B.

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T A B. II.

Numb. A or C.	Eq. of B.	1 Equa.		2 Equa.		Semidur.		
		M.	S.	M.	S.	H.	M.	S.
0	15	42	38	14	0	1	5	9
20	17	37	59	13	57	1	4	44
40	19	33	24	13	40	1	4	23
60	21	28	55	13	36	1	4	7
80	22	24	34	13	16	1	4	1
100	24	20	26	12	52	1	4	1
120	25	16	34	12	23	1	4	6
140	27	13	5	11	49	1	4	21
160	28	9	56	11	13	1	4	42
180	29	7	15	10	31	1	5	9
200	30	5	2	9	45	1	5	38
220	30	3	20	8	58	1	6	11
240	30	2	15	8	7	1	6	43
260	31	1	44	7	16	1	7	15
280	31	1	49	6	22	1	7	45
300	30	2	34	5	30	1	8	7
320	30	3	56	4	38	1	8	22
340	29	5	56	3	48	1	8	28
360	28	8	31	2	59	1	8	27
380	26	11	40	2	15	1	8	17
400	25	15	21	1	37	1	7	58
420	23	19	29	1	3	1	7	31
440	21	24	1	0	35	1	6	58
460	19	28	52	0	16	1	6	20
480	17	33	57	0	4	1	5	45
500	15	39	8	0	0	1	5	0

T A B.

T A B. II.

Numb. A or C.	Equ. of B.	1 Equa.			2 Equa.		Semidur.		
		H.	M.	S.	M.	S.	H.	M.	S.
500	15	0	39	8	0	0	1	5	9
520	13	0	44	23	0	4	1	4	39
540	11	0	49	32	0	16	1	4	15
560	9	0	54	31	0	35	1	4	3
580	8	0	59	15	1	3	1	4	0
600	6	1	3	39	1	37	1	4	7
620	4	1	7	38	2	15	1	4	23
640	3	1	11	7	2	59	1	4	49
660	2	1	14	6	3	48	1	5	19
680	1	1	16	30	4	38	1	5	54
700	0	1	18	16	5	30	1	6	28
720	0	1	19	27	6	22	1	7	2
740	0	1	20	0	7	16	1	7	33
760	0	1	19	55	8	7	1	7	57
780	0	1	19	16	8	58	1	8	15
800	1	1	17	58	9	45	1	8	26
820	2	1	16	9	10	31	1	8	30
840	3	1	13	52	11	13	1	8	26
860	4	1	11	3	11	49	1	8	16
880	5	1	7	50	12	23	1	8	0
900	7	1	4	14	12	52	1	7	37
920	8	1	0	20	13	16	1	7	8
940	10	0	56	11	13	36	1	6	40
960	12	0	51	48	13	49	1	6	8
980	13	0	47	15	13	57	1	5	37
1000	15	0	42	38	14	0	1	5	0

T A B.

T A B. III.

Days.	January.		Feb.		March.			April.			May.			June.											
	M.	S.	M.	S.	M.	S.	B	M.	S.	B	M.	S.	B	M.	S.	B									
2	4	S.	56	14	S.	18		12	S.	22	3	3	S.	29	4	3	A.	20	4	2	A.	30	5		
4	5		50	14		29		11		55	3	2		54	4	3		32	4	2		10	5		
6	6		43	14		37		11		27	3	2		17	4	3		44	4	1		49	4		
8	7		34	14		41		10		57	3	1		43	4	3		51	3	1		27	4		
10	8		22	14		43		10		25	3	1		9	3	3		58	3	1		44	4		
12	9		8	14		41		9		52	2	0		37	3	4		1	3	0		40	3		
14	9		52	14		36		9		16	2	0		6	3	4		3	2	0		10	3		
16	10		34	14		28		8		43	2	0		A.	25	2	4		2	2	0		S.	10	2
18	11		12	14		17		8		7	1	0		53	2	3		59	2	0		36	2		
20	11		47	14		5		7		31	1	1		20	2	3		54	1	1		21	1		
22	12		19	13		49		6		54	1	1		44	2	3		46	1	1		28	1		
24	12		48	13		31		6		16	1	2		8	1	3		37	1	1		53	1		
26	13		14	13		9		5		39	0	2		29	1	3		25	0	2		19	0		
28	13		36	12		4		5		1	0	2		48	0	3		11	0	2		43	0		
30	13		56					4		24	0	3		5	0	2		56	0	3		7	0		
31	14		4					4		6	0			2		2		47	0						

Days.	July.			August.			Sept.			October.			Nov.			Dec.						
	M.	S.	B.	M.	S.	B.	M.	S.	B.	M.	S.	B.	M.	S.	M.		S.					
2	3	S.	29	5	5	S.	41	3	0	A.	46	3	10	A.	50	2	16	A	10	9	A.	30
4	3		51	4	5		32	3	1		25	3	11		26	2	16		8	9		1
6	4		11	4	5		20	3	2		4	3	12		1	2	16		3	8		14
8	4		30	4	5		6	3	2		44	3	12		34	2	15		54	7		20
10	4		48	3	4		49	2	3		24	2	13		4	2	15		41	6		26
12	5		3	3	4		30	2	4		6	2	13		34	1	15		26	5		32
14	5		17	3	4		9	2	4		48	2	14		1	1	15		7	4		38
16	5		29	2	3		45	2	5		30	2	14		26	1	14		45	3		34
18	5		39	2	3		20	1	6		11	1	14		48	1	14		20	2		30
20	5		47	1	2		52	1	6		53	1	15		8	1	13		50	1		36
22	5		52	1	2		23	1	7		35	1	15		26	0	13		18	0		32
24	5		56	1	1		52	0	8		15	1	15		41	0	12		43	0	S.	28
26	5		57	0	1		19	0	8		55	0	15		52	0	12		5	1		24
28	5		55	0	0		45	0	9		35	0	16		2	0	11		24	2		20
30	5		52	0	0		10	0	10		13	0	16		8	0	10		40	3		26
31	5		49	0	0		A.	9	0				16		9	0				13		

A add, S subtraft.

P R O B. XV.

determine very nearly the Longitude of any Place upon the Earth.

Several ways have been attempted to perform this, but none of them so proper, so easy and certain, as that by the eclipses of Jupiter's satellites. And those of the first or nearest satellite happening frequently, afford the best means for this end, observing the precise time when any of them happens. But then it is necessary that the observer know beforehand, within a little, when these opportunities offer; lest he either let them slip, or grow weary by too long attendance. The method is thus,

1. He must know within a small matter the difference of longitude of *London*, and the place proposed, either by the common maps, or by the dead reckoning at sea. Turn this diff. longitude into time, allowing 15 degrees to an hour.

2. By the last prop. compute the time of the eclipse for *London*, and to this time add the time answering to the diff. longitude, if the place is east from *London*; or subtract it, if west: and you have the time when to look for the eclipse at that place. Therefore begin to observe a quarter of an hour before, with a telescope: And note the precise time in that place, when you see the beginning or end of the eclipse. Then the difference of this time, and the time for *London*, turned into degrees, will give the difference of longitude from *London*; which will be east if the time observed be after the time at *London*; but west if before.

Note, In observing, you must look on the right or west side of Jupiter for the Immersion; and on the

D

left

OF FINDING

left or east, for his Emerſion. And you need never look further from his body for either of them, than half, or at moſt $\frac{2}{3}$ his diameter.

Example.

If on *Auguſt* the 21^{ſt}, 1762, I be in one of the *Ladron* *Iſlands*; whoſe diff. longitude by eſtimation is about 140° E. from *London*: And I obſerve the beginning of the eclipse near 53 minutes paſt 2 o'clock next morning; and I find by computation that the ſame eclipse happened *Aug.* 21, at $21^{\circ} 42'$ paſt 5 at night; that is 9 h. $31\frac{1}{4}$ m. later in the iſland than at *London*; therefore its diff. longitude from *London* eaſt will be $142^{\circ} 49'$.

S C H O L I U M.

This method is ſo eaſy that one would wonder it is not more practiſed by ſeamen, when they go to remote countries. There being nothing more required than a common telescope of three feet long, or a reflecting telescope of one foot; and a clock or watch ſet to the true hour of the night in that place, by which to know the moment of the eclipse. And theſe eclipses happen very often; there being about four of them every week. It is true many of them happen in the day, or when Jupiter is below the horizon; and ſometimes clouds may interpoſe and prevent the obſervation. But there are frequent opportunities when none of theſe things happen; and when they do, one may ſave the labour of waiting upon them. I don't know whether this could conveniently be practiſed at ſea; but aſhore nothing is more eaſy. And one would expect that ſailors, above others, ſhould be more than

PART I. THE LONGITUDE.

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than ordinarily solicitous for making proper observations in distant countries, in order to settle the longitude of places; without which, their art must for ever remain imperfect.

To rectify your clock or watch in any place, observe when the star *Allioth*, or *Cassiopeia's* hip is in a plumb line with the pole-star (which is easily known by hanging up a line and plummet); and at that time the said star is upon the meridian, and therefore the time of night will be known by prob. 12, beforegoing.

Your watch may also be rectified by the sun, thus. Take one altitude of the sun before noon, and observe how much your watch wants of 12 o'clock. Then take an equal altitude after noon, and observe how much your watch is past 12. Then, as this number is greater or less than the former, your watch is too fast or too slow, by half their difference.

Note, There will be some small error, by the sun's latering its declination in the mean time, and by the ship's running northward or southward.

P R O B. XVI.

To find the Variation of the Compass.

RULE I.

By the Sun's true Amplitude.

Take the sun's amplitude by the compass, which is called the *magnetical amplitude*, just when his lower limb touches the horizon, or rather is half a diameter above it.

Describe the circle *SWNE* for the horizon; N 7. the north, E the east point. Set the sun's true

D 2

ampli-

FIG. amplitude at rising (found by prob. IV.) from E towards N, as to $\odot$, if it be north; but if south, towards S. Then set the magnetic amplitude from $\odot$ towards S, as to A, if it be north; but towards N, if south. Then make AB equal to EN , 90 degrees towards N; then AE or NB is the variation; which will be east, if B be between N and E ; and west, when between N and W .

And a like method may be used when the amplitude is taken at sun-set; using W (the west point) instead of E the east. And a figure may be drawn by hand, which will shew how to add or subtract the true and magnetic amplitude, for finding the variation.

In short, thus,

Having found how many points or degrees the amplitudes amount to; and having the sun in your face; then if the true amplitude be to the right hand of the magnetical, the variation is easterly; but to the left, westerly. And their difference is the variation. And the same holds true for an azimuth.

RULE 2.

By two equal Altitudes of the Sun.

- 8 Take two azimuths of the sun (by the azimuth compass) when he is at the same altitude, twice in one day; and set these azimuths from m (the magnetical south) to A and B , in their proper places. Bisect AB by the line SN , which will be the true meridian. Then Sm is the variation; which is east or west, according as mC continued, lies east or west from N .

And

And the *variation* is always half the sum, or *FIG.*
 half the difference of mA , mB ; according as m is 8
 without or between A and B ; and of the same
 sort as the greater azimuth; or of a contrary sort
 when the azimuths are northerly.

In short, thus,

Reckon what is the middle point between the two azimuths. Then, having the sun in your face; if the *magnetical meridian* be to the right hand of that point, the *variation* is east; but if, on the left, it is west. And this distance is the quantity of *variation*.

The variation may be found by drawing a meridian NS , by the *pole star*; or taking its bearing, just when it is in a plumb line with the star *Alto* or *Cassiopeia's hip*.

There is also a way to find the variation by a single azimuth, but very troublesome to calculate.

SCHOL.

The variation of the compass is continually altering. At *London* in the year 1580 it was $11\frac{1}{4}$ deg. east. In 1657 it was full north. In 1723 it was 12 deg. west, and now (1764) it is above 17 deg. And proceeds westward by a slow motion of one degree in about seven years. However, it does not move westward in all places, but in some places eastward, and in others is nearly at a stand. Likewise the increase or decrease of the variation is greater or less in different places.

A short TABLE of the variation of the compass, as has been observed in different places, which may be some guide to the mariner, when other helps fail him.

A TABLE of the Variation of the COMPASS.

	D.
Ascension I. — — —	1 W.
Azore Is. — — —	8 W.
Baffins Bay — — —	57 W.
Baltic — — —	12 W.
Barbary, N. W. Coast —	7 W.
— N. E. Coast — —	5 W.
Bombay — — —	8 W.
Brazil Coast, Lat. 10 S. —	6 E.
— — — Lat. 20 S. —	12 E.
British Channel — — —	15 W.
Canary Is. — — —	7 W.
Cape Comerin — — —	5 W.
— Frio — — —	12 E.
— of Good Hope — — —	16 W.
Chili W. Coast — — —	8 E.
England, West at Sea —	12 W.
France, W. Coast — — —	11 W.
— West at Sea, 10 deg.	8 W.
German Ocean — — —	14 W.
Guinea S. Coast — — —	5 W.
Gulf of Bothnia — — —	6 W.
Hudson's Bay — — —	30 W.
— Straits — — —	40 W.
Java Coast — — —	2 W.
Indian Sea — — —	14 W.
London — — —	16 W.
Madagascar W. Coast —	19 W.
— South of it, in Lat. 40	25 W.
Majorca	

		D.
Majorca I.	—	16 W.
Maldivia If.	— —	10 W.
Malacco	— —	2 E.
New England Coast	—	10 W.
Newfoundland C.	—	21 W.
New Guinea C.	—	6 E.
New Holland S. and W. Coast		4 W.
New Zeland	—	9 E.
Portugal Coast	—	9 W.
— West 8 deg.	—	6 W.
River Grand, before	—	14 E.
— Plate, before	—	19 E.
Saint Helena	—	2 W.
Sardinia	— —	13 W.
Sicily	— —	12 W.
Straits of Gibraltar	—	6 W.
— Magellan, E. Entrance		15 E.
— W. Entrance	—	13 E.
Terra Magellanica, E. Coast		19 E.
Tristian de Cunha J.	—	0
Van Dement's Land	—	1 E.
Virginia	— —	5 W.

But the mariner is not to depend much upon this table, the variation in most places being very uncertain, and in many places quite unknown. And besides, the variation is continually altering. Therefore he must omit no opportunities to take the variation at sea by observation, as in this problem is directed.

To find the Lee-way of a Ship by Observation.

R U L E.

1. If you are within sight of land, take the angle between the ship's keel, and that point of land which always bears on the same point of the compass: and this is her quantity of lee-way.

2. Or set the ship's wake with the compass; the angle between this and the keel is her lee-way. And here the ship's course is to be reckoned so much further from the wind, as is her quantity of lee-way; because the ship always drives from the wind.

S C H O L.

All ships do not make the same quantity of lee-way, but some a great deal more than others; and that difference proceeds from the different forms of their hulls, which may be infinitely varied. A person used to a particular ship will know better what lee-way she makes, than a stranger; and in this, experience is the best director. The general practice to allow for lee-way, is as follows.

1. The ship upon a wind, and all sails set, allow one point.

2. Top-sail reefs in, $1\frac{1}{2}$ point.

3. Hard gale, and one top-sail taken in; 2 points.

4. Hard wind, high sea, both top-sails in; 3 points.

5. Only main-sail and mizen out; 4 points.

6. Only main-sail out; 5 points.

7. Only

7. Only mizen out ; 6 points.

8. All sails furled ; 7 or 8 points.

In all these cases, a higher sea and harder wind increases the lee-way. Likewise respect must be had to the setting of the water, when it runs high ; which will increase or decrease the lee-way, according as it opposes or conspires with the motion of the ship : and must often be allowed for according to judgment.

Ships that draw most water make least lee-way ; and a ship out of her trim makes most lee-way. However, the way most to be depended on, is to set the wake of the ship with the compass, as directed in this problem.

P R O B. XVIII.

To find the Setting of a Current and its Velocity.

When there is a smooth sea and little wind, heave out the boat with three or four hands in her ; together with a compass, log-line, and half-minute glass ; and also a triangular board, the bigger the better. To one side of this board fasten as much lead as will sink it ; and to the three angles, tie three equal pieces of line ; and knot the other three ends together, and to this tie another line 100 fathoms long, or more. Some use a kettle tied by the bow, instead of this board.

When you are off from the ship, cast over your board, letting it sink 60, 80, 100, or 120 fathom, if your line will allow. Then fastening the line to the stern of the boat, it will bring her up, and make her ride as if she were at an anchor. Then cast over your log, turn up the glass, and as you veer out the log-line, set the drift of the log with the compass ; and this shews you how the current sets ; and the length of the log-

line run out will give the quantity of its motion. But you must add to the drift $\frac{1}{3}$ or $\frac{1}{4}$ part, according to the length of the line she rides at; for both the boat and the board will drive; but the bigger the board is, the less she will drive.

If this board be heaved out of the ship into the wake, and suffered to sink far enough, it will shew the apparent direction of the current, and the line run off compared with the ships way, will help to determine its velocity.

The direction of a current or great sea raised by the wind may be nearly conjectured from the position of the waves, that is, of the ridges and furrows of the sea. For the direction of the current's motion is always perpendicular, or across these waves.

A current's motion may be discovered by keeping an exact account of the ship's way, both outward and homeward, according to the dead reckoning. For the difference of the reckonings outward and homeward will shew the motion of the current, if it be continual.

S C H O L.

There are several places in which there is a continual current; as in the straits of *Gibraltar*, where the *Atlantic* sea runs continually into the *Mediterranean*, and in this place there is an under current setting the contrary way. In the *Baltic* sound there is a current, and four or five fathom deep an under current. There is a current from the *Euxine* sea, through the straits of *Constantinople* and *Proponitis*. There is a current setting northerly between *Florida* and the *Bahama* Islands, and in many other places; and in all such places,

it is probable there are under currents setting the contrary way.

If a ship be at rest, or have no motion in the sea, and at the same time the sea has a current towards any point: It is the same thing, as if there was no current, and that the ship sailed toward the same point, and with the same motion, the current was supposed to have.

Hence, if a ship sails upon any course in a current, instead of considering the current's motion, one may consider the ship as having a new course, the same as the current's motion is.

P R O B. XIX.

To describe the Times, Periods, and Directions of the Trade-Winds and Monsoons.

It is certain from experience, that in the temperate zones the winds are so variable and uncertain, that they blow from all points of the compass at all times of the year, without any distinction; but between the tropics and something beyond, they keep a certain regular course, either constantly the same, or variable by certain rules, according to the time of the year. And these winds, that blow constantly thus from some certain point of the compass, are called *trade winds*. And if they shift at certain periodical times of the year, they are called *Monsoons*. Concerning which, the following observations have been made.

1. Between the tropics, and as far as 30 deg. N. and S. latitude, there is constantly an easterly wind all the year, which would doubtless be the same quite round the globe, if it was not for the interposition of high mountains and continents,

that interrupt its motion in particular places, as in the *Indian* and *Chinese* seas, as will be explained afterwards. The limits of these trade winds are confined to a very little compass; for in passing these limits, the wind is found to change almost instantaneously. Likewise it is said, that a little without these limits, from 30 to 35 deg lat. there are generally westerly winds.

2. In places near the tropic of Cancer the wind is N. easterly; but near the tropic of Capricorn, S. easterly: Likewise, when the sun is near the tropic of Cancer, or all summer, these winds are a point or two more southerly; and in the winter more northerly. The motion of the sea likewise follows the course of these winds. All this is to be understood in open seas, where there is no interruption from the land. In the *Pacific* Ocean, or great South Sea, the winds are very fresh, and so regular and constant, that in sailing one scarce ever need attend the sails. Only near the land, as on the coast of *Peru*, and on the west of *Africa* in S. lat. and 100 leagues from *Guinea*, the wind is always southerly. Storms and tempests are seldom known in the South Sea. What has been said holds in general in open seas; for at or near the shore there is a great variety in the forces and directions of these winds, arising from the situation of mountains, vallies, woods, and the various disposition of the soil, as it is more or less capable of reflecting heat.

3. In the *Atlantic* and *Ethiopic* seas, the trade winds on the coast of *Africa* reach to about 28 deg. N. and S. lat. and at the *American* shore near 31° lat. and in this sea the S. easterly winds reach as far as 4 deg. North lat. and near the coast

coast of *Brazil* in *America* they are more easterly than in the same lat. near the *African* coast, where they are more southerly.

On the S. coast of *Guinea*, from *Sierra Leone* to *St. Thomas* Isle, the southerly and south-westerly winds are perpetual. Also on this coast there are frequent calms and tornadoes. In lat. 10. on that coast the wind is west, and in lat. 20 or 30, N. west.

Between 4 and 10 deg. N. lat. and 100 or 150 leagues from the *Guinea* coast, there is a tract of sea, wherein there are perpetual calms, attended with thunder, lightning, and frequent rains; whence this place is by navigators called the *Rains*.

Near the *Caribbee* islands there are often hurricanes in the month of *August*. Near these islands the wind bears more easterly, sometimes E. sometimes E. by S. yet commonly a point or two to the northward. And the strength of these winds gradually decreases, in sailing to the westward.

On the coast of *Brazil*, from *April*, the S. W. wind blows, and from *September* the N. E. And S. of *Brazil* it inclines more westerly. But on the W. coast of *America* the winds are westerly.

For the sake of these winds, all those that use the *West India* trade, even those going to *Virginia*, count it their best course to get as soon as they can to the southwards, that so they may be certain of a fair wind.

4. In the *Indian* ocean the winds are partly general, as in the *Ethiopic* and *Atlantic*; and partly periodical. Between the latitudes of 10 and 30 deg. S. the S. E. by E. wind blows all the year.

From 2 to 10 deg. S. lat. the S. E. wind blows from *June* to *November*; and the N. W. wind from *December* till *May*; this extent is a degree less.

less near *Madagascar*, and a degree more near *Java*. And this monsoon reaches as far as the *Molucco* islands.

From 3 deg. S. lat. northwards, the N. E. wind blows from *October* till *April*, a clear Breeze; and the S. W. or S. S. W. wind from *April* to *October*; this last is stronger, but accompanied with rainy weather. These winds are not so constant in the gulf of *Bengal*, as in the *Indian* sea.

Between *Madagascar* and the *African* shore, as far as the Equinoctial, the S. S. W. wind blows from *April* to *October*, which is more westerly near the line. The rest of the year it is easterly.

To the east of *Sumatra*, and in the coast of *Cambaia* and *China*, as far as the *Philippine* islands and *Japan*, the N. wind blows from *November* till *May*: and the S. wind from *May* to *October* or *November*; but these winds will vary a point or two sometimes. And between *New Guinea* and *Sumatra*, S. of the equinoctial, you have the same winds; but the N. wind is N. westerly, and the S. is S. easterly, but vary sometimes 5 or 6 points. Besides, the time of the changing of these winds is a month or six weeks later.

Between the S. end of *Madagascar* and the shore, the S. E. wind blows from *October* till *May*; and from *May* a west wind. Beyond *St. Laurence* into the sea a S. wind.

These contrary winds do not shift all at once, but are in some places attended with calms, in others with variable winds. The end of the westerly monsoon on the coast of *Coromandel*, and the two last months of the southerly monsoon in the *Chinese* sea, are very subject to be tempestuous, which renders the navigation of these seas unsafe at that time. These tempests are by our seamen called the *breaking up of the monsoons*.

By

By reason of the shifting of these winds, all those that sail in those seas are obliged to observe the seasons proper for their voyages; and so doing, they fail not of a fair wind and speedy passage. But if they chance to out-stay their time, till the contrary monsoon sets in, as it sometimes happens; they are forced to give over the hopes of accomplishing their intended voyages, and either return to the port from whence they came, or else put into some other harbour, there to spend the time till the winds shall come favourable.

P R O B. XX.

To determine the Position of the Sails of a Ship, in respect to the Wind; the Position of the Rudder; and Way of working a Ship.

The sails of a ship have more or less force to move the ship, according to the different position they have in respect of the ship's keel, as well as in respect to the wind; concerning which, observe these general

R U L E S.

1. Head sails serve to keep a vessel steady, and to make her ware. Main sails tend only to move the center of gravity of the ship. Mizzen sails keep a ship from sheering backwards and forwards; and serve to force a ship's stern to leeward. Sails have more force the tighter they are hoisted; and a sail that bags has less power. The higher a sail is placed, the more wind it will receive to move the ship. Wet sails draw more than dry ones.

2. Any

FIG. 2. Any one sail gives the greatest motion to the ship when it stands at right angles to the keel, and the ship goes directly before the wind. But in all the sails together, because one sail keeps the wind from another; if the wind come at an angle of about 60 degrees, they will have the most power to move the ship. Likewise the nearer a right angle any sail makes with the keel, or ship's way, the less lee-way she makes, and the further from a right angle, the more lee-way.

Again, the nearer the way of the wind is with the way of the ship, the less lee-way; and the more distant or across, the more leeway she makes.

9. 3. As to the most advantageous placing of the sails: If S be a ship, SD her way, SA the sail, WS the direction of the wind, or the point it blows from. Then if the ship lie near the wind, the angle WSA must be almost twice the angle ASD , that is, the angle between the wind and the sail, should be nearly double the angle between the sail and the keel. If the wind come near at right angles to the way of the ship; the angle WSA must be once and a half the angle ASD . And if she go almost before the wind, the sail must almost bisect the angle between the point of the wind and the keel. And such positions will give the greatest motion to the ship. And to cause her to gain the most to windward, the angle WSD must be 55, and WSA 35, ASD 20, or thereabouts; if any ship can lie so nigh the wind; if not, then they must be in that proportion.

4. If the wind come almost across the way of the ship, then the sharper the head sails are set, the more power they have to turn the ship's head about. Again, if the way of the wind be nearly the

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the same as the way of the ship; the sail ought to **FIG.** make an angle with the keel of 54 degrees. If 9. the wind make an angle of 40 or 50 deg. with the ship's way, the angle between the sail and the keel may be about 30 deg. And these positions will turn her fastest about.

5. The most advantageous position of the rudder, so as to have the greatest force possible in turning the ship about, is, when it makes an angle with the keel of $54\frac{1}{2}$ degrees. The faster a ship sails, the better she will answer her helm; if she sail very slow, she will scarce steer at all. If she heel much, she won't answer the helm so well.

P R O B. XXI.

To find the Place of turning to Windward.

Suppose *WA* be the direction of the wind, and **10.** the angle *WAD* or *WAF* the nearest a ship can lie to the wind. And if a ship sail from *A* to *B*; to find the point *C*, where she must turn to windward.

Having made the angles *WAD* and *WAF* the nearest the ship can lie to the wind; through *B* draw *BC* parallel to *FA* intersecting *AD* in *C*; then *C* is the place required.

Trigonometrically.

AB is given, and the angle *WAB* and *WAF* or *WAC*, then you have *BAC*, and *FAB* or its equal *ABC*; and from thence *ACB*. Therefore as $S.AC B : AB :: S.ABC : AC$.

P R O B.

66 TURNING TO WINDWARD.

FIG.

P R O B. XXII.

To find the Place of turning to Windward in a Current.

11. Suppose a ship sails from A to B in a current that sets in the direction AI , from A to I ; and if WA be the point of the wind; to find the place C where to turn to windward.

Make the angle WAE and WAF the nearest the ship can lie towards the wind. And make AE to EH , and AF to FG , as the motion of the ship to the motion of the current, and draw FG , EH parallel to AI ; then through G , H draw the lines AG , AHC . From B draw BC parallel to AG , and from C draw CD parallel to AF , and from B draw BD parallel to AI .

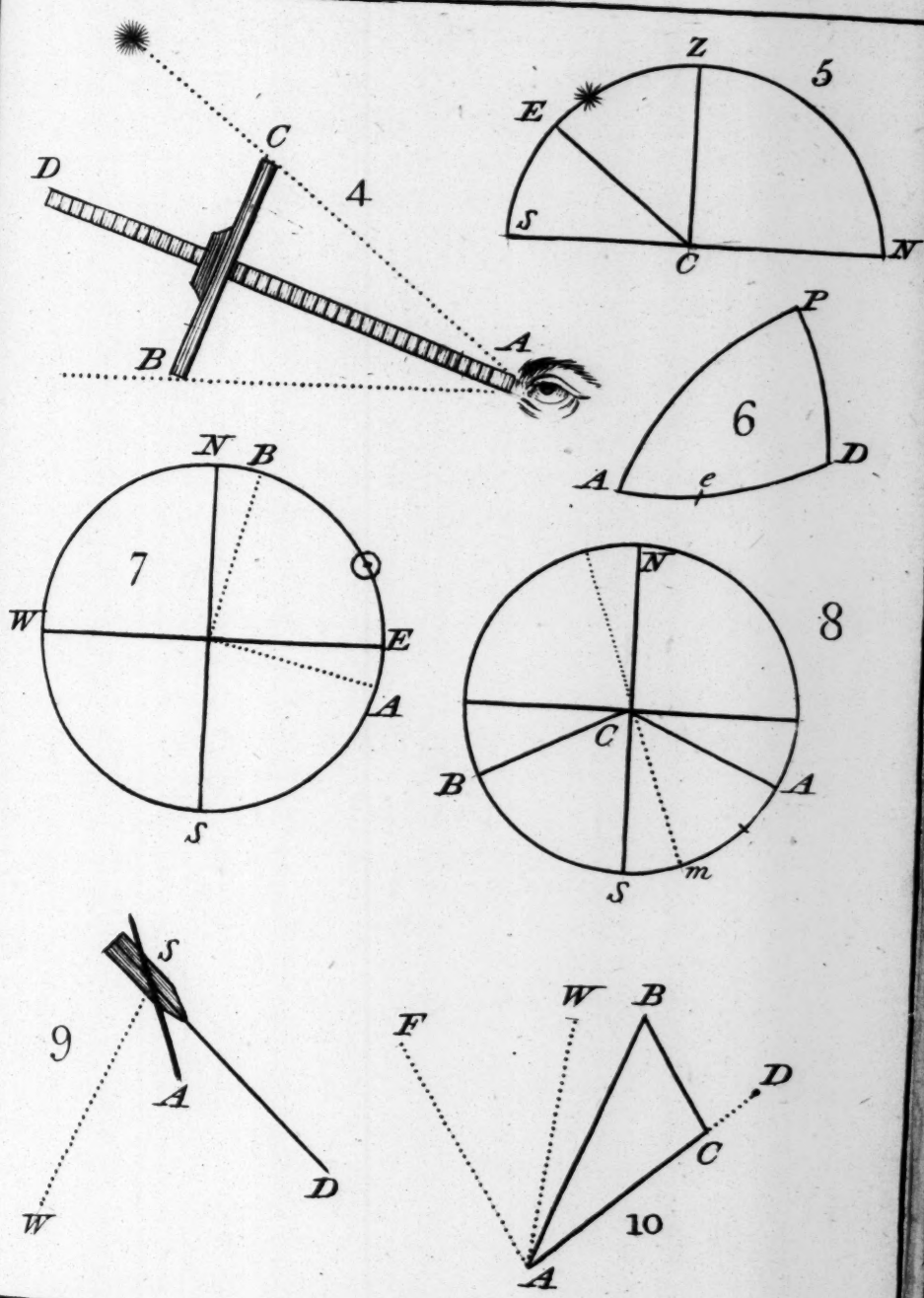
Then C is the point of turning to windward; and the ship is to steer the course and distance AC , and by the motion of the current she will be brought to C . Then she must steer the course and distance CD , and she will then by the motion of the current arrive at B , as required.

Here note, If the direction of the current be from I to A , the points G , H must be taken on the other side of the lines AF , AE : but the rest of the work is the same.

S C H O L.

It is scarce worth while to solve this trigonometrically. But they that have a mind, may find enough given in the triangles AHE , AFG , CDB . Many more questions might be proposed, of little use in the art of navigation; which if any one would know how to resolve, he must make himself well acquainted with plain trigonometry.

P R O B.





PROB. XXIII.

To find the Distance of a Cape or Head Land at Sea.

RULE.

Suppose you are sailing on some known course 12. at *A* towards *B*, and you see the cape *C*. Take the bearing of the cape *C* by the compass, from *A*.

Then after you have sailed a known distance *AB*, the same course; take the bearing of the cape again at *B*. Then there is given the distance *BA*, the angles *A* and *B*; subtract the sum of *A* and *B* from 180, the remainder is the angle *C* at the cape.

Then say, *As sine of angle C.*

Distance AB.

Sine angle B.

Distance AC, at the first observation.

SCHOL.

Suppose *C* is a castle or a ship where a gun is fired, and you would know the distance. By a watch count how many seconds there are between the firing and the report, which multiply by 185, will give the distance in sea miles. Or you may count the time by your pulse, allowing five beats to four seconds.

PROB.

FIG.

P R O B. XXIV.

To direct a Ship through the Sands, to a Harbour, or the Mouth of a River.

R U L E.

13. To do this there must be sea marks or light-houses set up on purpose; so that every two of them may stand in a right line passing through the road between two sands; and a ship is to sail along some of these right lines, till she come into some others of the right lines, and then change her course, according to the position of these sands.

Thus, *T, H, R, G, P, W*, are sea marks. And suppose a ship at sea is to sail into the river *F*; she must come either into the line *PW* as to *E*, or into the line *TH* as to *D*. Then she must sail in a right line with *TH*, or else with *PW*, till she come into a right line with *RG*. Then she must sail along the right line *RG*, till she is within the river. And thus she avoids the sands *A, B, C*.

There are often buoys placed in the road between one sand and another, which answers the same end in the day-time, where the passage is not very difficult; or where there are not convenient places for light-houses.

P R O B. XXV.

To compute the Power or Force of a Tackle.

R U L E.

14. Put 1 for the force at the hand, also mark every part of the same running rope with 1. And when one rope acts against several, mark it with the sum of all these it acts against. And every part of

of the same running rope must likewise be marked FIG. the same. Proceed thus till you come to the 14. weight.

Call the force at Ab , 1; also mark AC , 1; and CD , 1; then mark AB , 2; because it acts against Ab , AC ; likewise mark BC , 2. And BE (acting against AB , BC) must be marked 4. Lastly, CW (acting against AC , BC , DC) will be 4. Therefore the force of the hand is to the weight, as 1 to 4.

PROB. XXVI.

To gauge a Ship's Hold.

There being such great diversity in the shapes and forms of ships, that it is not to be expected there can be any one rule which can answer exactly for all ships. The practical rules laid down by several authors are as follows.

RULE 1.

Multiply her breadth, half breadth, and length in feet, together; and divide by 94, gives the tons.

RULE 2.

Multiply the length by the breadth, and the product by the depth, in feet; then divide by 100 for war-ships, or 95 for merchants that allow nothing for guns, gives the tons.

RULE 3.

Take her length from the stern-post to the upper part of the stem, subtract $\frac{2}{3}$ her breadth from that length; multiply the remainder by the whole breadth,

TO GAUGE A SHIP.

breadth, and that product by half the breadth, in feet ; and then divide by 100 or 94, gives the king's or merchant's tunage.

RULE 4.

The weight of a ship's burthen is half the weight of the water she can hold.

P R O B. XXVII.

The Diameter of an Iron Ball being given, to find its weight : and the contrary.

R U L E.

As 100 to the cube of the diameter in inches, so is 14 to the weight in pounds.

Example.

If the diameter be 4 inches, its cube is 64,

Then $100 : 64 :: 14 :$

$$\begin{array}{r} 14 \\ \hline 256 \\ 64 \\ \hline \end{array}$$

100)896(8.96 or 9 lb. the weight.

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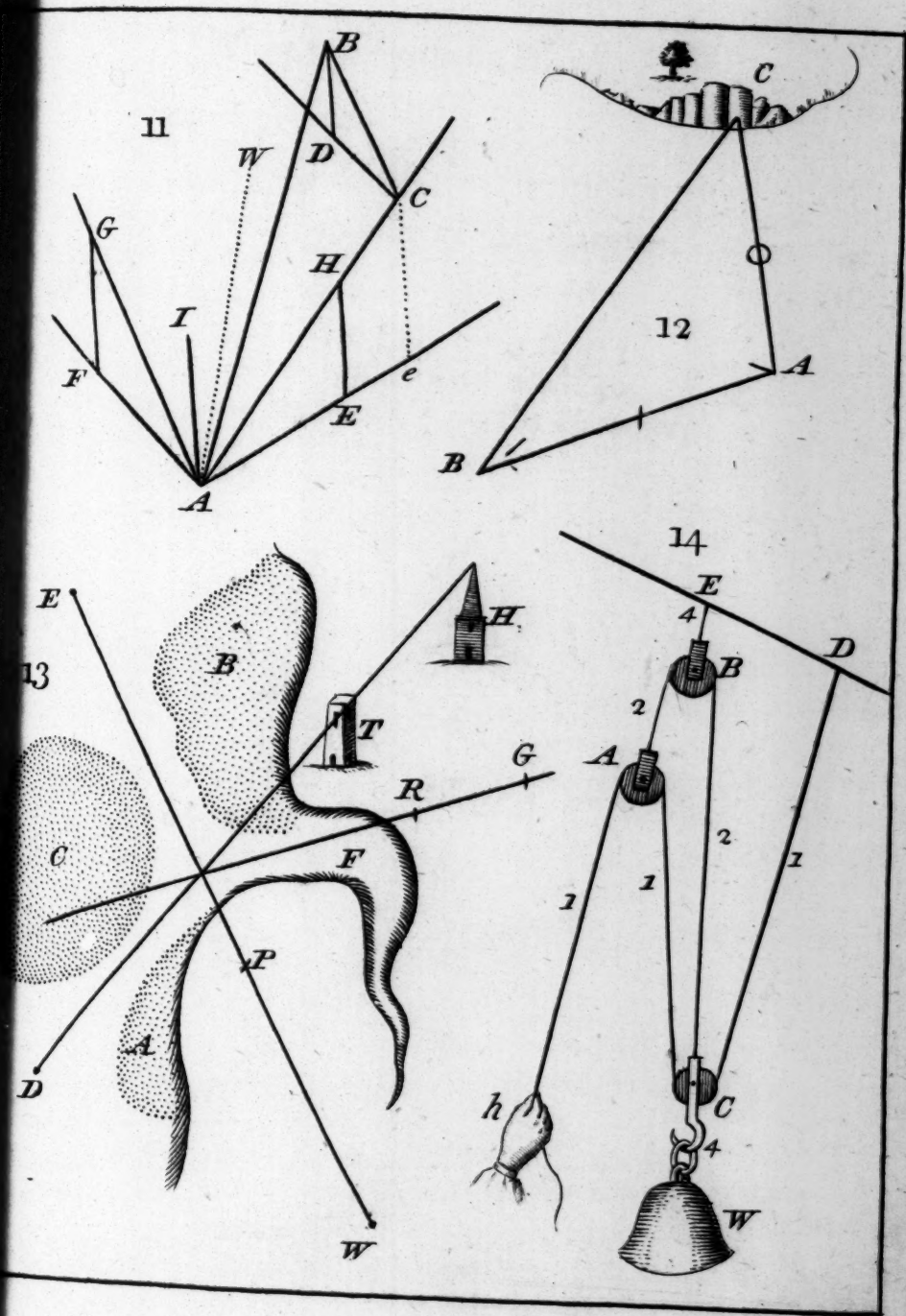
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II





PART I. WEIGHT OF A BALL.

71

If the weight be 63 lb.

$$\begin{array}{r} 14 : 63 :: 100 \\ 100 \end{array}$$

$$\begin{array}{r} 14 \overline{) 6300} (450 \text{ cube of the diameter.} \\ 56 \dots \end{array}$$

$$\begin{array}{r} 70 \quad \text{Its Log.} \quad 2.65321 \\ 70 \quad \text{Third part} \quad 0.88440 \\ \hline \text{Its numb. } 7.66 \text{ the diameter.} \\ 0 \end{array}$$

N A-

NAVIGATION.

PART II.

The Theory or fundamental Principles of
NAVIGATION.

FIG.

PLAIN SAILING.

PROP. I.

As Radius :
Distance run ::
Sine of the course :
Departure.

DEMONSTRATION.

17. Let ABF be the rumb line described by the ship; P the pole. Divide the rumb or distance AF into an infinite number of equal parts, AB , BC , CD , &c. through A , B , C , &c. draw the meridians PA , PB , PC , &c. and the parallels of latitude AL , Bk , Cp , Dg , &c. These will form an infinite number of small triangles ABk , BCp , CDg , &c. all equal and similar: for all the hypotenuses AB , BC , CD , &c. are equal by construction. And the angles kAB , pBC , gCD , &c. are equal by def. 9. Whence all the sides kA , Bp , Cg , &c. are equal; and also the sides kB , pC , gD ,

PART II. PLAIN SAILING. 73

gD , &c. Now in any one of the triangles, as FIG. ABk ; it will be, by plain trigonometry, As radius : 17. $S.kAB :: AB : kB :: BC : pC :: CD : gD$, &c. And by composition, rad : $S.kAB :: AB + BC + CD$, &c. : $kB + pC + gD$, &c. But $AB + BC + CD$, &c. or AF is the distance run, and $kB + pC + gD$, &c. is the departure, by def. 7. Therefore it is, as rad : $S.kAB ::$ distance run : departure; or alternately rad : distance :: $S.$ course (kAB) : departure. Q. E. D.

Cor. 1. As Radius :

Distance run ::

Cosine of the course :

Diff. latitude.

For by trigonometry, Rad : $S.kBA :: AB : Ak :: BC : Bp :: CD : Cg$, &c. :: (by composition) $AB + BC + CD$, &c. : $Ak + Bp + Cg$, &c. but $AB + BC + CD$, &c. = distance run = AF , and $Ak + Bp + Cg$, &c. = AR the difference of latitude. Therefore, Rad : $S.kBA$ or cos. course :: distance AF : diff. lat. AR . or alternately, rad : distance $AF ::$ cos. course : diff. lat. AR .

Cor. 2. As Radius :

Diff. latitude ::

Tan. course :

Departure.

For by this prop. radius : distance :: $S.$ course : departure :: (by cor. 1.) cos. course : diff. latitude. And alternately, cos. course : $S.$ course :: diff. latitude : departure. But by the nature of sines and tangents, cosine : sine :: radius : tangent. Whence rad : tan. course :: diff. lat. : departure.

E

Cor.

- FIG. *Cor.* 3. Hence if the *distance run*, the *difference*
 17. of latitude, and the *departure*, be laid out in right
 lines; they will form a true right angled plain tri-
 angle. And consequently the square of the distance
 run is equal to the sum of the squares of the de-
 parture and diff. latitude.

S C H O L:

This prop. and its corollaries will resolve all the
 cases of plain sailing, or those where no longitude
 is concerned.

Hence may be discovered a manifest difference
 between the departure and meridional distance.
 For in sailing from A to F , or from F to A , the
 departure is the same, being the sum of the lines
 kB , pC , gD , &c. which is greater than the meri-
 dional distance RF , when a ship sails towards the
 pole at F ; and less than the meridional distance
 AL , if she sails towards the equinoctial at A . For
 all the parts Bk , Cp , Dg , &c. of the departure, are
 greater than the correspondent parts Rm , mn , no ,
 &c. in the parallel RF ; and lesser than At , ts , so ,
 &c. in the parallel AL . And the departure is of
 a middle quantity between them.

The diff. of longitude is also different from
 both the departure and meridional distance. For
 as the meridional distance at F is RF ; and at A
 is AL ; and the departure between A and B is
 the sum of the lines Bk , Cp , Dg , &c. to Fi ; so
 the diff. of longitude is the arch of the equi-
 noctial contained between PA and PL , and there-
 fore is greater than any of the others. These
 three therefore, the meridional distance, de-
 parture, and difference of longitude, are all essen-
 tially different from one another. The diff. longi-
 tude is fixt and immutable when the places A , B ,
 &c.

PART I. PARALLEL SAILING. 75

are fixt; and so is the departure for a single course, FIG. whether backward or forward. But the meridi- 17. onal distance differs from itself in the places A, F ; and this is of no manner of use in navigation, all computations whatever depending upon the other two.

But though the departure is of a certain quantity, for any one given course; yet if there be several courses between any two places AF , the whole departure may be different. Thus, if one ship sails from A to L , and from L to F , she makes the departure AL . But if another ship sails from A to R , and thence, to F , she makes the departure RF , less than the former. And one of these is greater, the other less, than the departure in the direct course AF .

P R O P. II.

As Cos. latitude :

Radius ::

Distance of two places in one parallel :

Diff. longitude.

DEMONSTRATION.

The cosine of latitude is the radius of the parallel of the two places; and the radii of all circles are as the circumferences, or any correspondent parts thereof; therefore the radius of the parallel, is to the distance in that parallel :: as radius of the sphere, is to their distance in the equinoctial, or diff. longitude, by def. 5. that is, cos. latitude : radius :: distance of the places : diff. longitude.

Q. E. D.

Cor. The length of a degree of longitude in any parallel of latitude, is as the cosine of its latitude.

76 MID. LATITUDE SAILING.

FIG. For the diff. longitude being given ; the cosine
17. of the lat. to the distance in the parallel, will al-
ways be in a given ratio.

Schol. This prop. will resolve all cases of paral-
lel sailing, that is, of sailing directly east or west.

P R O P. III.

As Cosine of middle latitude :
Radius ::
Departure :
Difference of longitude, nearly.

DEMONSTRATION.

Suppose *A, F*, be two places, then it was shewn
in prop. I. that the departure is the sum of the
lines *kB, pC, gD*, &c. which sum is greater than
RF and less than *AL* ; and if the distance *AF* be
not great, it is nearly a mean between *RF* and
AL. Let *x* be in the middle between *A* and *R*,
then the parallel *xw* is nearly a mean between *RF*
and *AL*, therefore *xw* may be taken for the de-
parture, nearly. But by prop. II. it is as cos.
lat. of *x* : radius :: *xw* : diff. longitude ; that is
cos. middle latitude : radius :: departure : diff.
longitude, nearly. Q. E. D.

Cor. I. Cos. middle latitude :
Sine course ::
Distance run :
Difference of longitude.

For by this Prop. cos. mid. lat : rad :: dep. : dif. long.
and by Prop. I. rad : distance :: s. course : dep.

Therefore

PART II. MERCATORS SAILING. 77

Therefore ex equo, cos. mid. lat. : dist : : FIG.
S. course : dif. long. 17.

Cor. 2. Cosine mid. latitude :
Tan. Course : :
Difference of latitude :
Difference of longitude :

For by this prop. cos. mid. lat. : radius : : dep. :
dif. long. and by cor. 2. prop. I. rad : dif. lat. : :
tan. course : dep. and ex equo, cos. mid. lat :
dif. lat. : : tan. course : dif. long.

S C H O L.

This prop. and its corollaries will resolve all cases
of sailing where the longitude is concerned. And
if you take half the sum of the natural cosines of
the two latitudes, and (finding its logarithm) use
it instead of the cosine of middle latitude, these
proportions will be something more exact.

P R O P. IV.

As proper difference of latitude :
Meridional difference of latitude :
Departure :
Diff. longitude.

DEMONSTRATION.

Let *A, F* be two places, then it has been proved
in Prop. I. that the infinitely small triangles upon
the globe, *ABk, BCp, &c.* are all similar and
equal. And by the nature of Mercator's chart,
these triangles are each of them projected into
others upon the chart likewise similar to these,
and to one another; the angle of the course re-
maining

FIG. maining the same in both. Now in any small
 17. triangle as ABk , since its departure kB , by the
 construction of the chart, is so far enlarged as to
 be represented by its corresponding diff. longitude;
 therefore the dif. latitude Ak will be increased in
 the same proportion; that is, as kB : diff. longitude
 of kB or of A and B :: so proper dif. latitude Ak :
 to its representation in the chart, called its merid-
 ional diff. latitude, or meridional parts of Ak .
 Therefore from the similitude of all these trian-
 gles, it will be as

Meridional parts of Ak : dif. long. A, B ::
 Ak : kB :: Bp : pC :: Cg : gD , &c. :: (by com-
 position) $Ak + Bp + Cg$, &c. or AR : $kB + pC +$
 gD , &c. or the departure.

And again, as AR : departure :: merid. $p. Ak$:
 dif. long. A, B :: merid. $p. Bp$: dif. long. $B,$
 C :: merid. $p. Cg$: dif. long. C, D , &c. :: (by
 composition) sum of the meridional parts of $Ak,$
 Bp, Cg , &c. that is of AR : sum of all the dif.
 long. of AB, BC, CD , &c. or the dif. long.
 A, F . And alternately, as AR proper dif. lat. :
 Meridional parts of AR :: departure : dif. longi-
 tude of A and F . $\therefore E. D.$

Cor. As Radius :

Tan. course ::

Meridional diff. latitude :

Diff. longitude.

For by cor. 2. pr. I. rad. : Tan. course :: dif.
 lat. : departure :: (by this prop.) meridional dif.
 lat. : diff. longitude.

SCHOL.

This prop. and corollary will resolve all the cases
 of Mercators sailing, or where the longitude is
 concerned.

concerned, by help of a table of meridional parts, FIG. 17. by which the meridional diff. latitude is had.

The foundation of this prop. depends on the construction of Mercators chart; which construction is this:

All meridians in this chart are parallel to one another, and at the same distance as at the equator. In consequence of which, all parallels of latitude, and every part of them, will be represented in this chart, bigger than they really are upon the globe; and that in proportion of the cosine of latitude to radius. From the parallelism of the meridians it likewise follows, that every rumb line will be a right line in this chart, since any rumb cuts all the meridians at equal angles. Now to have the angle of the rumb, the same on the chart as it is on the globe; the contiguous parts of the meridian must also be increased in the same proportion as the parallel was increased, that is, as $\cos.$ latitude to radius, or which is the same, as radius to the secant of latitude. And hence it follows, that the degrees of the meridian in approaching the pole continually increase, as the secant of latitude increases. The lengths of the meridian line in this chart, from the equinoctial to all the degrees of latitude, being expressed by numbers and put into a table, are what they commonly call *Meridional parts*; and the difference of these numbers answering to the difference of lat. of two places, is called the *Meridional difference of latitude*. And as upon the globe; the rumb, the diff. latitude, and departure put in streight lines will form a right angle triangle; so their representatives in the chart, that is, the rumb, the meridional diff. latitude, and diff. longitude, will also form a right-angled triangle, similar to the former.

E 4

P R O P.

FIG.

17.

PROP. V.

From the table of sines and tangents, find the difference of the log. tangents of half the complements of the latitudes of two places; multiply it by 10000, and keep the product; then,

As the tan. of the constant angle

51, 38, or ————

As constant number, whose log. is

That Product ::

Tan. course :

Diff. longitude.

} 10.1015093:

DEMONSTRATION.

It is demonstrable (by the method of fluxions, and must here be taken for granted) that the length of the part of the meridian line in Mercator's chart, which represents the difference of latitude of two places upon the globe, is equal to the difference of the log. tangents of half the complements of the two latitudes, multiplied into the number 2.30258509, and that product into the radius of the sphere.

Now since the table of meridional parts are expressed in minutes; express the radius of the earth in minutes, and it contains 3437.7469, and this multiply'd by 2.30258509 gives 7915.705; which last number multiply'd into the difference of the said log. tangents, gives the meridional parts, or meridional diff. latitude; put D for the difference of the log. tangents, then 7915.705 D is the meridional parts; whence by Cor. Pr. IV. as the radius of the tables : mer. dif. lat. :: tan. course : dif. longitude, that is 10000000000 : 7915.705 D :: tan. course : dif. longitude. And dividing the two first terms by 7915.705, and multiplying by 10000,

PART II. LOG. TANGENTS. 81

10000, you'll have $12633100000 : 10000 D :: \text{FIG.}$
 tan. course : diff. longitude. And the log. of 17.
 12633100000 is 10.1015093, and is the log. tan-
 gent of the constant angle $51^\circ 38'$. Q. E. D.

SCHOL.

This prop. with the help of prop. I. will resolve
 all cases of sailing whatever.

In the few foregoing propositions I have demon-
 strated the truth of the chief methods of sailing
 now in use; and deduced them from their genuine
 principles, and fixed them upon their proper foun-
 dations. By which the reader will be enabled to
 see that this theory is not founded upon false
 principles, but upon such as are solid and true:
 And consequently that all calculations built here-
 on may be depended on as exact. What remains
 is to give the particular solution of all the cases
 of sailing, with some other things of use in this
 art of navigation.

PROP. VI. PROB.

*To resolve all the Cases of Sailing geometrically, by
 Scale and Compass.*

Make two right angled triangles, ABC, ADE . 18.

AB is the difference of latitude.

BC the departure.

AC the distance sailed.

AD the meridional diff. latitude (from the table).

DE the difference of longitude.

BAC the course.

Any two of these being given, the rest may be
 found, if the triangles are constructed. All lines

E 5

are

82 CASES OF SAILING.

FIG. are to be taken from, and measured upon, the
18. same scale of equal parts. And the angle laid
down by the help of a line of chords.

Or thus :

19. Here must be constructed two right angled triangles ABC , BCD .

AB is the diff. latitude.

BC the departure.

AC the distance sailed.

BAC the course.

CD the diff. longitude.

BCD the middle latitude.

Any two of these given will find out the rest,
by constructing the triangles.

P R O P. VII. P R O B.

To resolve all the Cases of Sailing by the Traverse Table.

1. Cases of Plain Sailing.

In this table, you have the difference of latitude, and departure standing together, in the proper column of the course; over-against which, on the side, is the distance run; any two of which being given, finds the rest.

If any of the given terms be greater than the table contains, it must be taken out at twice or oftener; or take out the tenth part only, and then multiply by 10.

2. Cases of Mercator.

Seek the meridional difference of latitude in the column *Lat.* under the proper course; and adjoining

PART II. CASES OF SAILING. 83

adjoining thereto in the column *Dep.* is the diff. FIG. longitude; and any two, being given, finds the 19. third.

3. *Cases of middle latitude.*

Seek the complement of middle lat. in the column of *degrees* or *points*, then in the column *Dep.* you have the departure; over-against which on the side, in the column *Dist.* you'll have the diff. longitude; and any two being given finds the third.

P R O P. VIII. P R O B.

To resolve all the Cases of Sailing by Gunter's Scale.

This scale is very expeditious for resolving any proportion, when the first and one of the middle terms are of one denomination; and the other middle term and the last likewise of one. The numbers are to be taken off the line of numbers; the sines off the line of sines; and the tangents off the line of tangents, &c. The proportions wrought here are drawn from the foregoing propositions.

General Rule.

1. Set one foot of the compasses in the first term of the proportion; and extend from the first term to one of the middle terms, on its proper line: This extent will reach from the other middle term to the fourth term required, on its proper line. Reckon backward from 90 for co-sines.

2. Both extents must be made from lesser to greater terms, or else both from greater to lesser;
E 6 and

FIG. and each extent must be upon one single line, of
 19. the proper denomination. Observe radius is of any denomination; it is the sine of 90, or 8 points; and the tangent of 45 or 4 points; all at the end of the scale.

3. If you are extending from any given angle on the tangents, and the extent reaches beyond the line: You must set it as far back as it reaches over. Or proceed thus; set one foot at 45 (or 4 points) and note where the other foot falls, and keep it fixed there, and extend the other to the given angle. This extent set from 45 (or four points) will fall on the 4th term, or angle required. For co-tangent take the complement, for they stand together on the scale.

4. If the meridional diff. latitude be a term in the proportion, it is found thus. Extend from one lat. to the other, on the line *Merid.*; and set that extent on the line *E.P.* and note to what number it reaches, for that is the merid. diff. latitude. Likewise on the contrary, the meridional diff. latitude taken off the line *E.P.* and set on the line *Merid.* will reach from one lat. to the other.

5. When in the given proportion, one term is on the sines, and its corresponding one is on the tangents; that on the sines must be reduced to the tangents; thus, find the degrees on the sines, from which go directly over to the tangents, and you have the place you must extend to or from, instead of the sine; and this tangent term is always below 45° .

P R O B.

P R O B. IX. P R O B.

To make a Mercator's Chart, and to resolve the Cases of Sailing by it.

1. *By Gunter's Scale.*

Draw the right line *FI* for the equinoctial, and ¹⁵*FG* perpendicular to it, for a meridian, upwards for north lat. Then with your compasses take 10, 20, 30, &c. from the line *E.P.* and set from *F* to 10, 20, 30, &c. in the line *FI*; to be continued as far as you will; through which points draw lines parallel to *FG* for meridians, as 10, 10 : 20, 20 : 30, 30, &c. then with your compasses take 10, 20, 30, 40, &c. from the line *Merid.* and set these extents from *F* to 10, 20, 30, 40, &c. as far as you please in the meridian *FG*. Through all which points draw lines parallel to the equinoctial *FI*, for parallels of latitude, as 10, 10 ; 20, 20, &c.; likewise from the line *Merid.* set off the intermediate degrees upon *FG*. Then graduate the equinoctial *FI* and the meridian *FG*, and number them as in the fig. And in one or more places put the mariner's compass, with the rumbs. So your chart is finished.

If you draw meridians and parallels the same way, below the equinoctial *FI*, you will have a chart for south latitude.

2. *By a Table of Meridional Parts.*

Let a chart be made from lat. 49 to lat. 58 ¹⁶. N. draw *FI* for the parallel of 49, and *FG* perpendicular thereto for the meridian: And make *F1*, 12, 23, 34, &c. each equal to 60, taken off any scale of equal parts; or else divided equally by the compasses;

FIG. compasses; and through the points 1, 2, 3, 4, &c.
 16. draw lines parallel to *FG*, for meridians. Then from the table take the meridional parts of 49, 50, 51, 52, &c. and subtract that of 49 from each of the rest, and you will have the remainders 93, 187, 283, 382, &c. take these off the same scale of equal parts, or off the equinoctial *FI*, and set them from *F*, upon the meridian *FG*, to 50, 51, 52, &c. and also upon *ID*; through which points draw right lines parallel to *FI*, for the parallels of latitude; and number the degrees as in the figure. Also divide the degrees 12, 23, &c. as also 49, 50; 50, 51, &c. into minutes if there is occasion. Lastly, draw the mariner's compass and rumb, and you have finished your chart.

A plain chart is easier made; for all the divisions of the meridian *FG* are only to be made equal to those in *FI*, and therefore it needs no further explication.

The Use of the Chart in resolving the Cases of Sailing.

1. The latitude and longitude of a place being given; its place will be found at the intersection of the meridian of the place and its parallel of latitude, with a pair of compasses. And if any place upon the chart be given; its latitude is had on the side, and the longitude on the foot of it.

2. The course is easily laid down or measured by a line of chords; or by laying a ruler parallel to the proper rumb.

3. The difference of longitude is always measured on the foot of the chart, but the departure and distance are both measured on the side: always observing

PART II. MERCATORS CHART. 87

serving to set one foot of the compasses as much FIG. above one latitude, as the other foot is below the 14. other latitude. Or if both places lie in one parallel, one foot must be as far above, as the other is below it. And thus any two being given, finds the third.

Example.

Let A, C be two places in the chart. Draw 15. AC and BC parallel to FI ; then AB measured on the meridian (from 20 towards 40) gives the difference of latitude. And BC , measured on the foot of the chart, is the diff. longitude; BAC is the course; BC measured on the side of the chart, gives the departure. And AC , measured on the side, gives the distance.

Or thus, for the Distance:

Having the diff. latitude, take it from the foot of the chart, and set one foot of the compasses in some point d , so that the other foot (turned about) may just touch some parallel as at e ; which parallel intersects AC (the line of distance) in f ; then df measured on the foot of the chart is the distance.

Or thus:

Take the diff. lat. from the foot of the chart, and set it from A to g , and draw gb parallel to FI , then Ab , applied to the foot of the chart, gives the distance; and gb applied the same way gives the departure.

And by having the distance given; by a reverse operation, the other latitude may be found.

The

FIG. *The Solution of all the Cases of Sailing in particular.*

Having shewn the method of resolving all cases of sailing in general, I come now, for the sake of the less experienced, to give all their solutions in particular: And that by several methods; so that in practice every body may take which he likes best.

In working any of these proportions with the pen; you must take the logarithms of the several numbers, and set them down in order; and then add the logarithms of the second and third terms together, and from the sum subtract the logarithm of the first term, so have you the logarithm of the fourth term; which being found in its proper table will shew what the fourth term is.

The middle latitude is had, by taking half the sum of the two latitudes. Likewise, if you subtract one lat. from double the middle latitude, you have the other lat. In finding the middle latitude, take it rather too big than too little. All this only holds good, when both places are on one side the equinoctial; but when they are on different sides, take a mean between the equinoctial and the greater latitude.

The meridional diff. latitude is found, by subtracting the meridional parts of the lesser lat. from those of the greater, taken from the table of meridional parts: Or by adding them, if the two places be on different sides of the equinoctial.

And if you have one latitude, and the meridional diff of latitude, add or subtract (as the case requires) this merid. diff. lat. to or from the meridional parts of the known lat. And the table of meridional parts will shew the other latitude.

Being thus furnished with all the necessary data, you may pursue your computation, in calculating the place of a ship, for a single course, as follows.

Note,

PART II. CASES OF SAILING. 89

Note, You must mark what is given with a dash FIG. (—), and what is sought with a cypher (0).

The several Cases of Plain Sailing, or where no Longitude is concerned.

PROP. X. Case I.

Course and Distance run being given, to find the diff. Latitude and Departure.

Example.

Suppose a ship to sail 300 miles N. E. by N. $3^{\circ} 7'$ easterly.

I. Geometrically.

Draw CA for the meridian; make the angle 20° . ACB 3 points and $3^{\circ} 7'$. and make CB 300; on CA let fall the perpendicular BA ; then CA measured on the scale is 240, the difference of latitude. And AB 180 the departure.

II. By the Traverse Table.

Look for the course 37, or $3\frac{1}{4}$ points in the table, and over-against the distance 30 you have 24.0 the diff. lat. and 18.0 the departure; therefore for the distance 300, you will have 240 the diff. latitude, and 180 the departure.

III. By Logarithms.

<i>As Radius</i>	—	10.00000
<i>Distance 300</i>		2.47712
<i>Cof. course (36 52)</i>		9.90310
<i>Diff. lat. 240.</i>		2.38022
And <i>Radius</i>	—	10.00000
<i>Distance (300)</i>	—	2.47712
<i>Sine course (36 52)</i>		9.77811
<i>Departure (180)</i>		2.25523

So the diff. latitude is 240, and departure 180.

IV.

PLAIN SAILING.

IV. By Gunter's Scale.

Extend from radius or 90 to the course (36 52) reckoned backwards on the line of fines (or S. rums); the same extent will reach from the distance (300) to the diff. latitude 240, on the numbers.

And the extent from radius, on the fines (or S. rums) to the fine of the course 36 : 52 (or 3 $\frac{1}{4}$ points); will reach (applied the same way) from the distance 300, to the departure 180 on the line of numbers.

Note, This is the most common case in sailing.

PROP. XI. Case 2.

Course and Diff. Latitude given, to find the Distance and Departure.

Example.

Suppose a ship sails S. E. by S. making the diff. lat. 1 d. 10 m. or 70 m.

I. Geometrically.

21. Draw CA for the meridian, on which set the diff. lat. 70 from C to A ; and make the angle ACB 3 points (or 33 45) for the course; and at A raise AB perpendicular to AC . Then CB measured is 84, the distance; and AB , 46, the departure.

II. By the Traverse Table.

Look for the course 3 points (or 33 45) in the table; and in the column *Lat.* under the said course, find the diff. lat. 7, against which (in the column

PART II. P L A I N S A I L I N G. 91

column *Dist.*) is 8.4 the distance; and in the co-FIG. lumn *Dep.* 4. 6. the departure. And the diff. 21. lat. being 70, the distance will be 84, and the departure 46.

Here, as the diff. lat. cannot be found exactly in the table; you must take a proportional part of the difference, as is common.

III. By Logarithms.

<i>As Cos. course</i> (33 45)		9.91984
<i>Diff. lat.</i> (70)	—	1.84509
<i>Radius</i>	—	10.
<i>Distance</i> , 84	—	<u>1.92525</u>

And <i>Rad.</i>	—	10.
<i>Diff. lat.</i> (70)	—	1.84509
<i>Tan. course</i> (33 45)	—	<u>9.82489</u>
<i>Departure</i> , 46	—	1.66998

IV. By Gunter.

The extent from the course (33 45 or 3 points) reckoned backwards to radius, on the fines; will reach from the diff. lat. 70, to the distance 84 on the numbers.

And the extent from the complement of the course (56 15) to the course (33 45) on the fines; will reach from the diff. lat. (70) to the departure 47, on the numbers. Or the extent from rad. to tan. course, on the tangents, will do the same.

P R O P.

PLAIN SAILING.

PROP. XII. Case 3.

Course and Departure given; to find the Distance and Diff. Latitude.

Example.

Let a ship sail N. W. by W. and her departure 84 miles.

I. Geometrically.

22. Draw BA (84) for the departure, and AC perpendicular to it; and make the angle ABC the complement of the course, 3 points or (33 45); then BC measured, is 101 the distance; and AC 56, the diff. latitude.

II. By the Traverse Table.

Seek for the proper course (56 15 or 5 points) in the table, find the departure (8.3) the nearest; against which, in column *Lat.* is 5, 6 the diff. latitude; and in column *Dist.* is 10 the distance; therefore when the departure is 84, the diff. lat. is 56 and distance 100.

III. By Logarithms.

As <i>S. course</i> (56 15)	—	9.91984
<i>Radius</i>	—	10.
<i>Departure</i> (84)	—	1.92427
<i>Distance</i> 101	—	2.00443
And <i>Tan. course</i> (56 15)		10.17510
<i>Radius</i>	—	10.
<i>Departure</i> (84)	—	1.92427
<i>Diff. latitude</i> , 56	—	1.74917

IV. By

IV. *By Gunter.*

Extend from the S. course (56 15 or 5 points) to radius on the fines; this applied to the line of numbers, will reach from departure (84) to the distance 101.

And the extent from the course (56 15 or 5 points) to the complement of the course (33 15 or 3 points) on the fines; will reach from the departure (84) to the diff. latitude 56, on the numbers.

P R O P. XIII. *Case 4.*

Distance and Difference of Latitude given, to find the Course and Departure.

Example.

Let a ship sail N. easterly 100 miles, making the diff. latitude 74.

I. *Geometrically.*

Draw *CA* for the meridian, on which set 74 23. the diff. lat. from *C* to *A*; at *A* raise the perpendicular *AB*; then with extent of 100 the distance run, and one foot in *C*, with the other cut the line *AB* in *B*. Then *AB* measured is 67, the departure; and the angle *ACB*, measured by the line of chords, is 42 15, the course.

II. *By the Traverse Table.*

Find the distance 10 on the side, over-against which in some of the columns *Lat.* find 7.4, the diff. latitude; adjoining to which is 6.7 the departure in column *Dep.*; and at top the course $3\frac{3}{4}$ point, or 42 deg. And when the distance is 100, the departure is 67.

III. *By*

III. By Logarithms.

<i>As Distance (100)</i>	—	2.00000
<i>Radius</i>	—	10.
<i>Diff. latitude (74)</i>		<u>1.86923</u>
<i>Cof. course, 42 16</i>	—	9.86923
<i>And as 1</i>		0.
<i>Sum of dist. and diff. lat. (174)</i>		2.24054
<i>Their difference (26)</i>	—	<u>1.41497</u>
<i>Square of the dep.</i>	—	3.65551
<i>Half the log.</i>	—	1.82775
<i>gives the departure</i>	—	67.

Otherwise the departure may be found by case 1, having the course.

IV. By Gunter.

The extent from the distance (100) to the diff. latitude (74) on the numbers; will reach from radius to 42 16, the course, reckoned backward on the fines.

Take the sum and difference of the distance and diff. latitude. The extent, on the numbers, from 1 to the difference, will reach from the sum to a fourth, then half of the extent from 1 to this 4th, is 67 the departure. You may find it otherwise by case the 1st, by having the course.

P R O B. XIV. Case 5.

Distance and Departure given; to find the Course and Diff. Latitude.

Example.

A ship sails S. easterly 100 miles, and makes 74 miles departure.

I. *Given*

I. Geometrically.

Draw AB equal to 74 for the departure, on 24. which raise the perpendicular AC for the meridian; with one foot in B make the distance BC 100; then AC measured by the scale is 67, the diff. latitude; and ACB measured by the line of chords is 47 45 the course.

II. By the Traverse Table.

Find the distance 100 on the side, over-against which in some of the columns *Dep.* find 7.4 the departure; adjoining to which, in column *Lat.* is 6.7 the diff. latitude; and at bottom the course 48. Since the distance is 100 the diff. lat. will be 67.

III. By Logarithms.

As Distance (100)	—	2.00000
Radius	—	10.
Departure (74)	—	1.86922
S. course, 47 44	—	<u>9.86923</u>

Find the sum and difference of the distance and departure.

Then log. sum (174)	2.24054
Add the log. diff. (26)	<u>1.41497</u>
Half the log.	— 3.65551
is diff. lat. 67.	— <u>1.82775</u>

Or the diff. latitude may be found by case 1, having the course.

IV. By

IV. *By Gunter.*

The extent from the distance (100) to the departure (74) on the numbers, will reach from radius to 47 45 the course, on the sines. Then,

The extent from radius to the course 47 45, reckoned backwards on the sines; will reach from the distance (100) to the diff. latitude 67, on the numbers.

The diff. lat. may also be found in the same manner as the departure was, in the last case.

PROP. XV. *Case 6.*

Difference of Latitude and Departure given; to find the Course and Distance.

Example.

There are two ports *C* and *B*, whose diff. lat. is 72, and the southermost *B* lies 54 miles west from the meridian of the other place *C*.

I. *Geometrically.*

25. Draw the meridian *CA*, and set the diff. lat. (72) from *C* to *A*; at *A* erect the perpendicular *AB*, 54 for the departure. Draw *BC*, which measured is 90, the distance; and the angle *BCA*, measured by the line of chords, is 36 50, the course from *C* to *B*.

II. *By the Traverse Table.*

Look through the column's *lat.* and *dep.* till you find the diff. latitude and departure (7.2 and 5.4) standing together. Then you have the course 36 50 points at top; and over-against them on the side, is the

PART II. MERCATORS SAILING. 97

the distance 9, or rather 90, because the diff. lat. FIG. is 72.

III. By Logarithms.

As Diff. latitude (72)	—	1.85733
Radius	—	10.
Departure (54)	—	1.73239
Tan. course, 36 52	—	9.87506

And then the course being known,

As Cos. course (36 52)	—	9.90310
Diff. latitude (72)	—	1.85733
Radius	—	10.
Distance, 90		1.95423

IV. By Gunter.

The extent from diff. latitude (72) to the departure (54), on the numbers; will reach from radius, to 36 50 the course, on the tangens. Then,

The extent from the course (36 52) reckoned backwards to radius, on the sines; will reach from the diff. latitude (72), to the distance 90, on the numbers.

The Cases of sailing, where the Longitude is concerned.

P R O P. XVI. Case 1.

The Latitude and Longitude of two Places being given; to find the Course, &c.

Example.

Let one place be N. lat. 51. longitude 1 : 0.

The other place N. lat. 53 45, longitude 8 30.

F

Then

FIG. Then the diff. lat. is 2 45 or 165 miles.
 Diff. long. 7 30 or 450 miles.
 Merid. diff. lat. 270 m.
 Mid. lat. 52 22.

I. *Geometrically.*

- 26 Draw the meridian AB , and set the meridional diff. latitude (270) from A to B ; at B raise the perpendicular BC equal to the diff. longitude (450), and draw AC ; then the angle BAC measured by a line of chords, is 59 deg. the course.

Or thus,

- 27 Make the angle BCD equal to the middle latitude (52 22) and CD the diff. longitude (450); from D draw DA perpendicular to BC , and make BA the difference of latitude (165); draw AC , then BAC measured on the chords, is (59 d.) the course: and AC the distance.

II. *By the Chart.*

- 16 Find the places A , C in the chart, and draw AC , and the meridian AB . Then the angle BAC measured on the chords, is (59 d.) the course. And AC applied to the side of the chart is 5 d. 20 m. or 320, the distance.

Or thus,

Lay a rule over the two places A , C , and find what rumb is parallel to the ruler's edge, and that is $5 \frac{1}{4}$ points, or N. E. by E. $\frac{1}{4}$ easterly, for the course.

III. *By the Traverse Table.*

Look through the column's *Lat.* till you find the merid. diff. lat. 27, and adjoining to it the diff. lon-

PART II. MERCATORS SAILING. 99

longitude 45 in column *Dep.* the nearest is 27.2 FIG. and 45.4; then at bottom you have the course $5\frac{1}{4}$ points.

IV. By Mercator.

As Meridional diff. lat. (270)	2.43136
Radius	10.
Diff. longitude (450)	2.65321
Tan. course, 59 2	10.22185

V. By Middle Latitude.

As Diff. latitude (165)	—	2.21748
Diff. longitude (450)	—	2.65321
Cof. mid. lat. (52 22)	—	9.78576
		12.43897
Tan course, 59 1	—	10.22149

VI. By the Log. Tangents.

Find half the complements of the lat. of the two places, 18 7, and 19 30; and then the difference of their log. Tangents, .03437; multiply it by 10000, and reserve the product 343.7; then,

As that product (343)	—	2.53529
Constant log. (tan. 51 38)		10.10151
Diff. longitude (450)	—	2.65321
		12.75472
Tan course, 58 54	—	10.21943

VII. By Gunter.

Extend from one lat. (51) to the other (53 45) on the line *merid.* and apply that extent to the line *E. P.* and note the degrees ($4\frac{1}{2}$) or 270 miles. Then the extent on the numbers, from $4\frac{1}{2}$ (or
F 2 270

100 MERCATORS SAILING.

FIG. 270) to the diff. longitude $7 \frac{1}{2}$ (or 450); will reach from radius to tan. course, 59 d.

Or thus,

Count the mid. lat. (52 22) backwards on the fines, against which on the tangents you have 31 25; then the extent from diff. lat. (165), to diff. long. (450), on the numbers; will reach from tan. 31 25 to tan. course 59 deg.

S C H O L.

If the distance be required, the course must first be found by this case; and from that the distance by case 2, plain sailing.

16 But the distance may be found by the *chart*. thus: Take the diff. lat. (2 45) from the foot of the chart, and set one foot in some point *d*, so that the other foot (turn'd about) may just touch some parallel, as at *e*; which parallel intersects *AC* (the distance of the places) in *f*; then *df* measured on the foot of the chart, is 5 20 the distance.

P R O P. XVII. *Case 2.*

The Latitude and Longitude of two Places being given; to find the Departure.

Example.

One place in N. lat. 51, long. 1.
The other place N. lat. 53 45, long. 8 30.
Then the diff. lat. is 165 miles.
The diff. long 450 m.
Merid. diff. lat. 270 m.
Mid lat. 52 22.

I. Gau

PART II. MERCATORS SAILING. 101

I. Geometrically.

FIG.

Draw the meridian AB , and set the proper diff. latitude (165) from A to d , and the meridional diff. latitude (270) from A to B ; on AB raise the perpendiculars BC , de ; make BC the diff. longitude (450), and draw AC , then de measured is the departure, 275.

Or thus,

Make the angle BCD the middle latitude (52 27), and CD the diff. longitude (450); draw DB perpendicular to BC ; then BC measured is the departure.

II. By the Chart.

Let A , C be the two places: Take the diff. longitude BC , and apply it to the graduated meridian; so that one foot may reach as far above the latitude of one place, as the other reaches below the other latitude; then the degrees intercepted (43 36) turned into miles, is the departure, 276.

III. By the Traverse Table.

Find the complement of middle latitude (37 38) in the column of *Degrees* or *Points* at top; and on the side, in the column *Dist.* the diff. longitude (450, or rather 45); against which, in column *Dep.* you have (27.5) the departure. Therefore the departure is 275. Here, as the degrees are not to be found exactly, you must take a proportional part.

IV. By Mercator.

As Merid. diff. latitude (270)	2.43136
Diff. longitude (450) —	2.65321
Proper diff. lat. (165)	<u>2.21748</u>
	4.87069
Departure, 275 —	2.43933

F 3

V. By

V. By Middle Latitude.

As Radius	—	10.
Cos. mid. latitude (52 22)		9.78576
Diff. longitude (450)	—	2.65321
Departure, 275	—	1.43897

VI. By the Log. Tangents.

Find the course by case 1 ; and then the departure by case 2 of plain sailing.

VII. By Gunter.

Extend from one lat. (51) to the other (53 45) on the line *Merid.* and apply that extent to the line *EP.* and note the degrees ($4\frac{1}{2}$), which turn into miles (270) ; then the extent on the numbers, from these miles (270) to the diff. latitude (165) ; will reach from the diff. longitude (450), to the departure, 275.

Or thus,

Extent from 90 on the fines, to the mid. lat. (52 22) counted backwards ; will reach from diff. longitude (450), to the departure (275), on the numbers.

P R O P. XVIII. Case 3.

The Latitude of two Places, and the course being given ; to find the Difference of Longitude.

Example.

Let one place be N. lat. 20.
 The other place N. lat. 37.
 The diff. lat. 17 d. or 1020 m.
 The course N.N.E. 2 19 easterly.
 Merid diff. lat. 1168 m.
 Mid. latitude 28 30.

PART II. MERCATORS SAILING. 103

FIG.

I. Geometrically.

Draw the meridian AB , and set the merid. diff. 28 lat. (1168) from A to B . raise BC perpendicular to AB ; and make the angle BAC (24 49) the course. Then BC measured is (540 or 9 deg.) the diff. longitude.

Or thus,

Draw AB equal to the diff. latitude (1020), 29 and BC perpendicular to it; then make the angle BAC (24 49) the course. Make the angle BCD (28 30) the mid. latitude; then CD measured is the difference of longitude, 540.

II. By the Chart.

Lay a ruler upon the first place A , parallel to its 15 proper rumb, and note where the edge of it cuts the parallel BC of the second place, as in C ; then take the distance CB , (between C and the meridian of the first place A ;) and apply it to the equinoctial or foot of the chart, and it gives 9 d. or 540 m. the diff. longitude.

III. By the Traverse Table.

Under the course (24 50) in column *Lat.* find the meridional diff. lat. (11.68); then adjoining thereto in column *Dep.* is the diff. longitude 5.4; then the diff. longitude is 540.

IV. By Mercator.

Radius	—	10.
Tan. course (24 49)	—	9.66503
Merid. diff. lat. (1168)		<u>3.06744</u>
Diff. Long. 540		2.73247

F 4

V. By

MERCATORS SAILING.

V. *By middle Latitude.*

<i>Cof. mid. latitude</i> (28 30)	9.94389
<i>Tan. course</i> (24 49)	9.66503
<i>Diff. lat.</i> (1020)	3.00860
	<u>12.67363</u>
<i>Diff. long.</i> 537	2.72974

VI. *By the Log. Tangents.*

Take half the complements of the latitude of the two places 35, and 26 30; find the difference of their log. tangents .14749, multiply it by 10000, and keep the product 1475; then,

<i>As Constant log.</i> —	10.10151
<i>that product</i> (1475)	3.16879
<i>Tan. course</i> (24 49)	9.66503
	<u>12.83382</u>
<i>Diff. longitude</i> , 540	2.73231

VII. *By Gunter.*

Extend from one lat. (20) to the other (37), on the line *Merid.* Set that extent on the line *E. P.* and note the degrees cut, 19 30. Then the extent from rad. to tan. course (24 49); will reach on the numbers, from these degrees (19 30) to the diff. longitude 9 degrees.

Or thus,

Count the mid. lat. (28 30) backwards from 90 on the sines; even against which on the tangents is 41 18. Then the extent from tan. 41 18, to tan. course (24 49); will reach from diff. lat. (17 deg.), to diff. longitude (9 deg.) on the numbers.

SCHOL.

S C H O L.

FIG.

If both latitudes and the distance be given; to find the diff. longitude; the course must first be found by plain sailing.

P R O P. XIX. Case 4.

The latitude of two places and the departure given; to find the difference of longitude.

Example.

Suppose the latitudes to be 20 d. and 37 d. and the departure 472 miles; the course N. easterly.

Diff. lat. 17 d. or 1020 m.

Merid. diff. lat. 1168 m.

Mid. lat. 28 30.

I. Geometrically.

Draw the meridian AB , and make Ad the diff. lat. (1020), and AB the merid. diff. lat. (1168); raise the perpendiculars BC , de ; make de (472), the departure; and draw AeC ; then BC is the diff. longitude 540 or 9 degrees.

Or thus,

Draw the meridian AD , make AB (1020) the diff. latitude; and draw BC perpendicular to it, and equal to the departure (472); make the angle BCD (28 30) the middle latitude; then CD measured is 540, the diff. longitude.

II. By the Chart.

Take the departure (472 or 7 d. 52 m.) off the side of the chart; setting one foot as much above one latitude A , as the other foot is below the other latitude B ; apply it to the foot of the chart, and you have the diff. of longitude 9 degrees.

F 5

III. By

FIG.

III. *By the Traverse Table.*

Find the complement of middle latitude ($61^{\circ} 30'$) in the title of *Degrees* or *Points*. And in the column *Dep.* find the departure (47.2); over against which, in the column *Diff.* on the side, is 54 the diff. longitude; therefore the diff. longitude is 540 or 9 deg.

IV. *By Mercator.*

As <i>diff. latitude</i> (1020)	3.00860
<i>Departure</i> (472)	2.67394
<i>Merid diff. lat.</i> (1168)	3.06744
	<u>5.74138</u>
<i>Diff. longitude</i> , 540	<u>2.73278</u>

V. *By middle Latitude.*

As <i>Cosine mid. lat.</i> ($28^{\circ} 30'$)	9.94389
<i>Radius</i>	10.
<i>Departure</i> (472)	2.67394
<i>Diff. longitude</i> , 538	<u>2.73005</u>

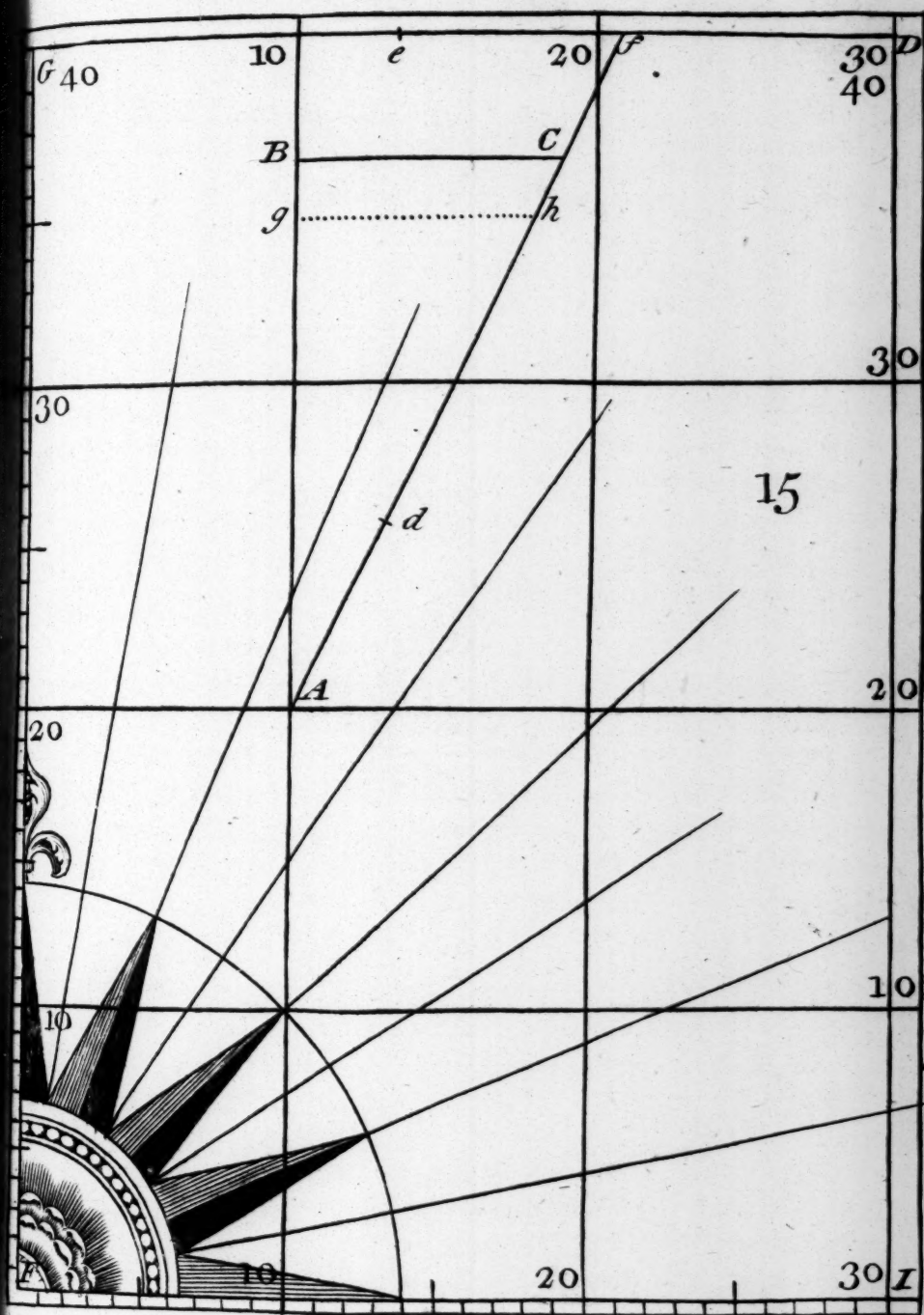
VI. *By the Log. Tangents.*

First find the course ($24^{\circ} 49'$) by Case 6th of Plain Sailing, and then the diff. longitude (540) by the last Case of this.

VII. *By Gunter.*

Extend from one lat. (20) to the other (37) on the line *Merid.* Set that on *E. P.* and note the degrees $19^{\circ} 30'$, or 1170 miles. Extent on the numbers, from diff. lat. (17 deg.) to these degrees ($19^{\circ} 30'$) will reach from the departure (472), to the diff. longitude 540 miles or 9 deg.

Or



PART. I

Exter
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Or thus,

Extent from the mid. lat. reckoned backwards (28 30), to 90, on the fines; will reach from the departure (472), to the diff. longitude 540 on the numbers.

Note, this is a very usual case in mercator.

P R O P. XX. *Case 5.*

One latitude course, and difference of longitude being given; to find the other latitude.

Example:

A ship sails S. W. by W. 2 47 westerly, from lat. 53 45, till her diff. of longitude be 7 d. 30 m. or 450 miles.

Mer. parts of the given lat. 3839.

I. *Geometrically.*

Draw AB (450) for the diff. longitude, and 32 make the angle BAC (30 58) the complement of the course; draw CB perpendicular to AB ; then CB measured is 270, the meridional diff. latitude. This taken from the meridional parts of 53 45, viz. 3839, leaves 3569 the meridional parts of the other lat. 51 deg.

II. *By the Chart.*

Let C be the given place; draw the meridian 16 CD , and the parallel CB equal to (7 30) the diff. longitude. Through B draw the meridian BA , and make the angle DCA (59 2) the course, draw CA intersecting BA in A ; then A is the other place.

FIG.

III. *By the Traverse Table.*

In the column of *points* or *degrees*, find the course ($5\frac{1}{4}$ points), and in column *Dep.* the diff. longitude (454); then adjoining thereto in column *Lat.* is (272) the meridional diff. lat. this subtracted from the meridional parts of the known latitude, leaves (3567) the meridional parts of the latitude sought $50^{\circ} 59'$.

IV. *By Mercator.*

As <i>Tan</i> course (59 2)	10.22179
<i>Radius</i> _____	10.
<i>Diff. longitude</i> (450)	<u>2.65321</u>
<i>Mer diff. lat.</i> 270	<u>2.43142</u>
From mer. parts of 53 45	3839
Subtract _____	<u>270</u>
Rem. the mer. parts	3569
Of the other lat. 51° deg.	

Note, if the mer. dif. lat. come out greater than the *M. P.* of the given lat. the lat. required is on the other side of the equinoctial.

V. *By middle Latitude.*

Take the given lat. for the middle latitude, Then,

As <i>Tan</i> course (59 2)	10.22179
<i>Cof. mid latitude</i> (53 45)	9.77181
<i>Diff. longitude</i> (450)	<u>2.65321</u>
	<u>12.42502</u>
<i>Diff. latitude</i> , 160	2.20323

By this find the mid. lat. $52^{\circ} 25'$; and repeating the operation with this mid. lat. you'll get 164 the diff. lat. and consequently the other lat. is 51° .

VI. *By*

VI. *By the Log Tangents.*

As <i>Tan. course</i> (59 2)	—	10.22179
<i>Diff. longitude</i> (450)		2.65321
<i>Constant log.</i>	—	10.10151
		12.75472
<i>A fourth</i> 341	—	2.53293
Divide 341 by 10000		.0341
<i>Tan. half compl. given</i>	}	9.51477
<i>Latitude</i> (18 7)		
Add	—	.0341
<i>Tan.</i> (19 30)		9.54887

Therefore 19 30 is half the complement of the other lat. consequently the other latitude is 51 deg.

VII. *By Gunter.*

The extent from the course (59 2) to radius on the *Tangents*; will reach from the diff. longitude ($7\frac{1}{2}$) to a fourth, ($4\frac{1}{2}$) on the *Numbers*.

Take these degrees (4 30) from the line *E. P.* and set it on the line *Merid.* from the lat. left, (53 45), and it will reach to 51 the lat. required.

S C H O L.

When only one latitude is given, and the difference of longitude is required; the other latitude must first be found by plain sailing; before the longitude can be found.

If both latitudes and distance be given; to find the diff. longitude; the course must first be found by plain sailing.

Parallel

FIG.

Parallel sailing, or sailing East and West admits of three Cases, as follows.

P R O P. XXI. Case 1.

Given the latitude and difference of longitude of two places in one parallel; to find their distance.

Example.

Suppose the latitude be $53^{\circ} 45'$, and diff. longitude $7^{\circ} 30'$, or 450 m.

I. Geometrically.

- 33 With center A , and sine of 90 , describe the arch DE : From a scale of equal parts, take the diff. longitude (470), and set it from D to E , and draw AE . From the sines take the complement of the latitude ($36^{\circ} 15'$), and set from A to B and C ; then BC measured on the scale of equal parts, gives 270 the distance.

Or thus,

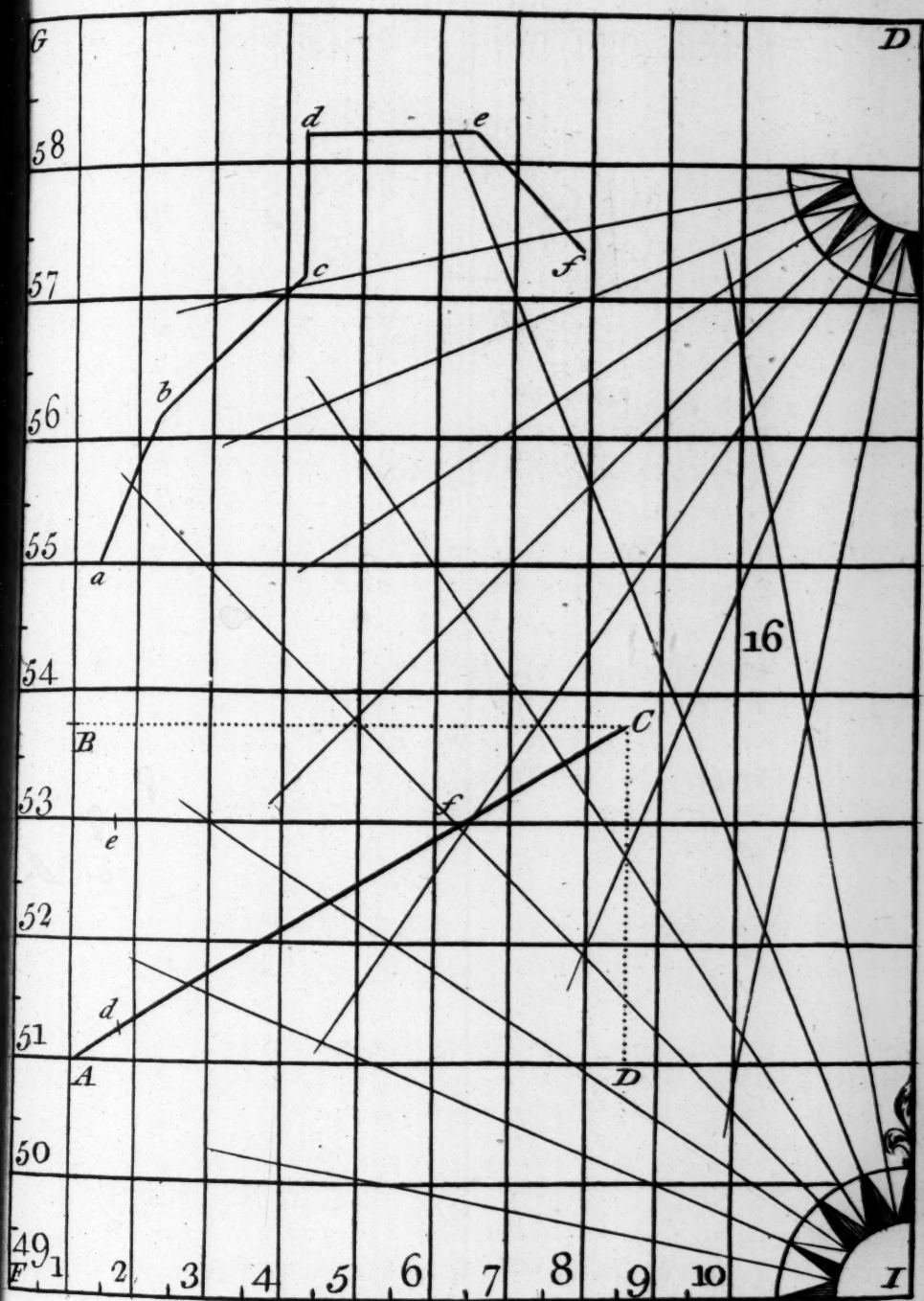
- 34 Make the angle BCD ($53^{\circ} 45'$) the latitude, and CD (450) the diff. longitude; draw DB perpendicular to BC ; then BC measured is 270 the distance.

II. By the Chart.

- 16 Let B, C , be the two places; take BC (450) and apply it to the side of the chart, so as one foot may be as much above the given latitude, as the other is below it; and this gives the distance $4^{\circ} 30'$ or 270.

III. By the Traverse Table.

In the column of *Degrees or Points*, find the latitude ($53^{\circ} 45'$), and the diff. longitude 45 on the side,





PART II. PARALLEL SAILING. 111

side, in column *Dist.* against which in column *FIG.* *Lat.* is the distance, 26.4 ; therefore the distance is 264.

IV. By the Sphere.

As Radius	—	10.
Cos. latitude (53 45)		9.77181
Diff. longitude (450)		<u>2.65321</u>
Distance, 266	—	2.42502

V. By Gunter.

The extent from radius to the lat. (53 45) reckoned back from 90, on the sines ; will reach from the diff. longitude (450) to the distance (268), on the numbers.

Or thus,

Against the latitude (53 45) on the line of *Chords*, you have on the line *M. L.* the miles contained in one degree of longitude (35) ; multiply this by the diff. longitude ($7\frac{1}{2}$), and you have the distance 263.

Or extent from 1 to $7\frac{1}{2}$, will reach from 35 to 263, on the numbers.

P R O P. XXII. Case 2.

The Latitude and Distance, of two Places in one Parallel, being given ; to find their difference of longitude.

Example.

Let the latitude be 53 45, and distance 266 miles.

I. Geometrically.

With sine of 90 describe the arch *DE*, and 33 with sine of (36 15) the comp. latitude, the arch *BC*. Draw *AD*, and make *BC* (266) the distance,

112 PARALLEL SAILING.

FIG. tance. Draw *ACE*, then *DE* measured is (450) the diff. longitude.

Or thus,

- 34 Make the right angle *DBC*, make *BC* the distance (266), and angle *BCD* (53 45) the latitude; then *CD* measured is (450) the diff. longitude.

II. By the Chart.

- 16 Take the distance in degrees (266 or 4 26) from the side of the chart, so as one foot of the compasses may be as many degrees above the given latitude (53 45), as the other is below it; apply it to the foot of the chart, and you have the diff. longitude 7 30.

III. By the Traverse Table.

In the column of *Degrees* or *Points*, find the latitude (53 45); and in column *Lat.* the distance (26.6) against which in column *Dist.* on the side, is 45, that is, 450 the diff. longitude.

IV. By the Sphere.

As <i>Cof. Latitude</i> (53 45)	9.77181
<i>Radius</i>	10.
<i>Distance</i> (266)	2.42488
<i>Diff. Long.</i> 450	2.65307

V. By Gunter.

The extent from the lat. (53 45) reckoned backwards from 90, to radius on the fines; will reach from the distance (266) to the diff. longitude (450), on the numbers.

Or thus,

Note, What number in the line *M. L.* stands against the lat. (53 45) on the *Chords*: Then the extent

PART II. PARALLEL SAILING. 113

extent from that number (35) to 60, or 1 deg. FIG. on the numbers, will reach from the distance (266), to the diff. longitude 454, or 7 34.

P R O P. XXIII. Case 3.

The Distance of two Places in one Parallel, and their Difference of Longitude given; to find the Latitude.

Example.

Let the distance be 266 miles, and diff. longitude 7 30, or 450 miles.

I. Geometrically.

Draw AD , and from A with sine of 90, describe the arch DE . Set the diff. long. 450 from D to E , and draw DE , AE . Set the distance (266) from D to F , and draw FC parallel to AD . Then AC measured on the fines is 36 15, the comp. lat. 53 45.

Or thus,

Make the right angle DBC , and BC (266) the distance, and CD (450) the diff. longitude. Then the angle BCD , measured on the chords, is (53 45) the latitude.

II. By the Chart.

Take the diff. longitude (7 30) from the foot of the chart, and set that extent, on the side, in such latitudes, that the feet of the compasses may just intercept the distance (266 or 4 26); then in the middle between the feet of the compasses is the latitude 53 45.

III. By the Traverse Table.

Look through the columns *Lat.* till you find (26.6) the distance, standing against (45) the diff. longi-

FIG. longitude, on the side; then the degrees belonging to that column *Lat.* is 54 the latitude.

IV. *By the Sphere.*

As <i>Diff. Longitude</i> (450)	2.65321
<i>Distance</i> (266) —	2.42488
<i>Radius</i> ———	10.
<i>Cof. Latitude</i> , 53 46	<u>9.77167</u>

V. *By Gunter.*

The extent from diff. longitude (450) to the distance (266) on the numbers; will reach from sine of 90 to the latitude 53 45, reckoned backwards.

Or thus,

The extent from 450 to 266 will reach from 60 to $35\frac{1}{2}$, the miles in 1 degree of longitude; then against $35\frac{1}{2}$ on the line *M. L* is 53 45 on the *Chords* for the lat.

P R O P. XXIV.

To work a Traverse, or compound Course.

Example.

Suppose a ship sails from lat. 55 N. on the following courses.

Points or Courses.	Distances in Leag.
N.N.E.	26
N.E.	30
N.	22
E.	24
S.E.	26

PART II. TRAVERSE SAILING. 113

FIG.

I. Geometrically.

This is done by laying down successively every 36 course and distance one after another, till the whole be finished. Thus, let a be the point sailed from, draw the meridian as , and make the angle sab equal to the first course N. N. E. and the distance ab (26). Then make the angle abc equal to that which the second course makes with the first, and make bc (30) the second distance. And thus make every angle c, d, e equal to those which every two succeeding courses make with one another; and make cd, de, ef , their proper distances run. So is f the place of the ship at last.

Or thus,

Describe a circle about a as a center, with all the rumbs; then draw all the courses parallel to their respective rumbs, and equal to the several distances sailed.

Or thus,

Draw thro' all the points b, c, d, e , as you find 36 them, so many meridians parallel to the first as . And make the angles with these lines, at the points b, c, d, e ; equal to their respective courses from the meridian; setting on each line ab, bc, cd , &c. the proper distance run. So is f the place of the ship. This is more exact than the former, but more troublesome.

Lastly, let fall fs perpendicular to sa , then sa is the diff. latitude, and sf the departure. And the direct course saf , and distance af , may be found by case 6, of plain sailing.

II. By

FIG.

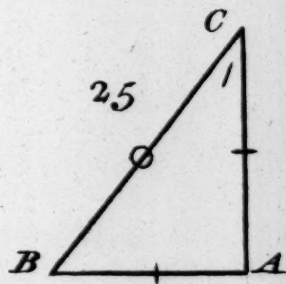
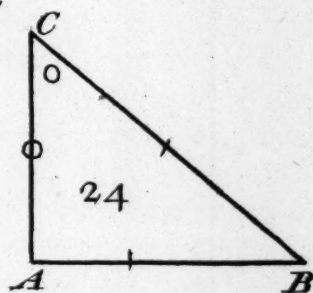
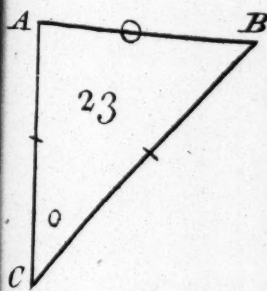
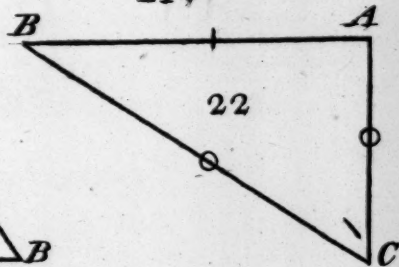
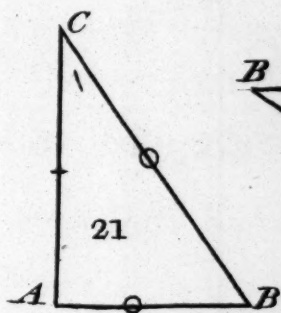
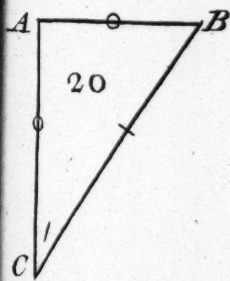
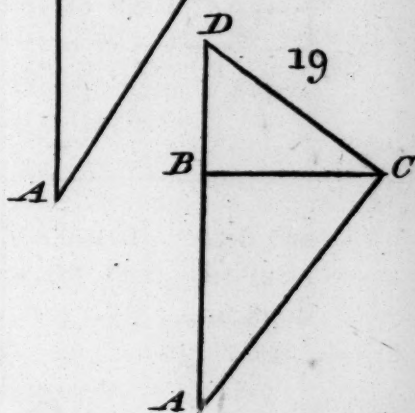
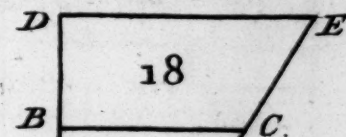
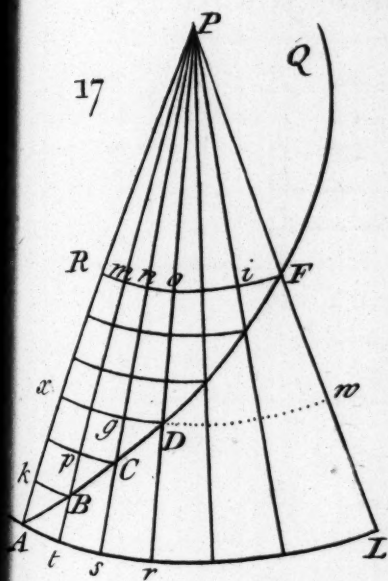
II. *By the Chart.*

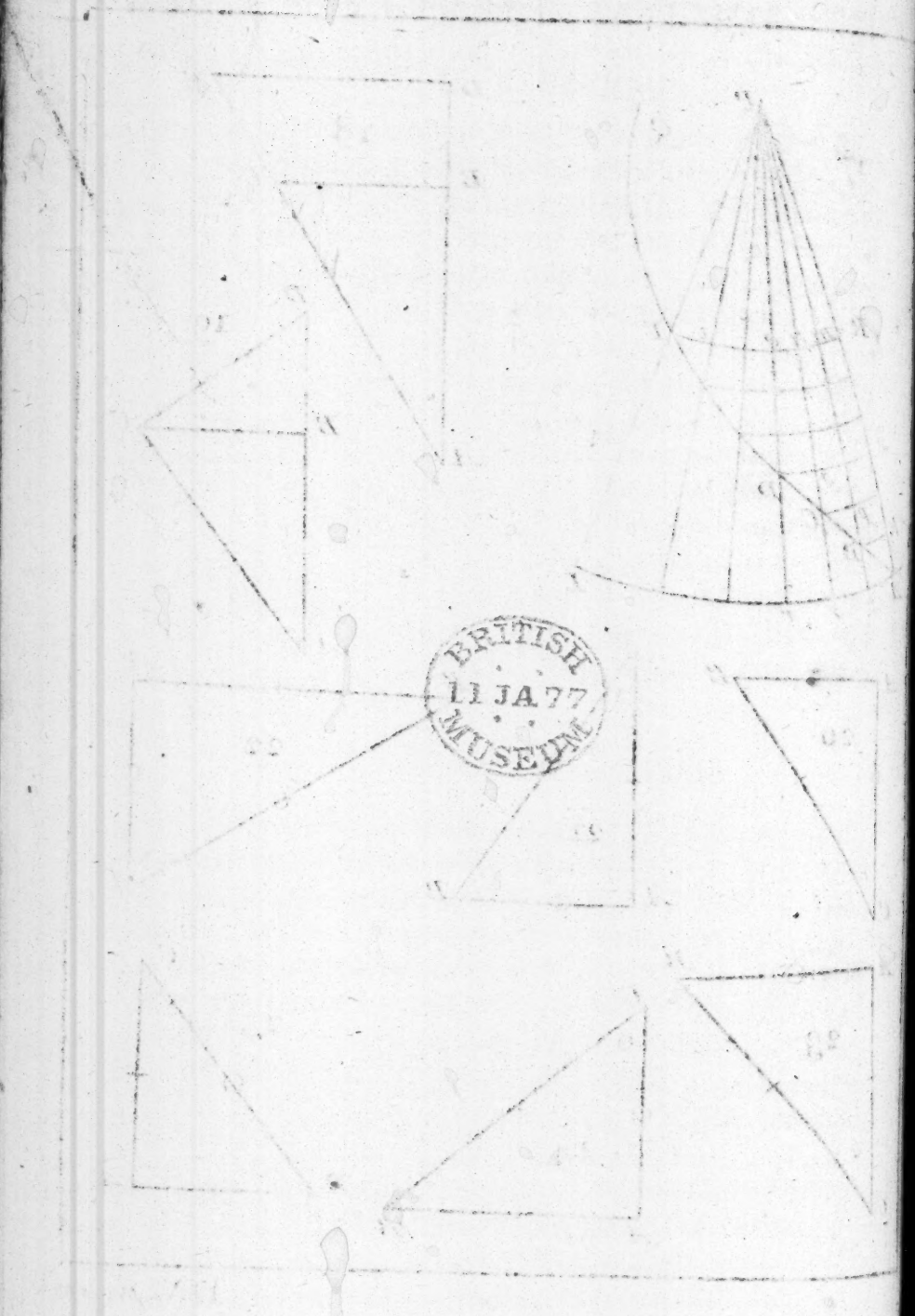
- 16 Lay a ruler upon *a* the first place of the ship, parallel to the N. N. E. rumb or first course; and draw a line, and set thereon 26 the first distance to *b*, which is to be taken off the side of the chart, in the same latitude the ship is in; then you have *b* the place of the ship after the first course. Again, lay a ruler upon *b* the last place of the ship, and parallel to the next course N. E. and draw a line, setting thereon 30 from *b* to *c*, to be taken always from the side of the chart in the same latitude the sails in; and thus you have the next place of the ship, *c*. And thus laying a ruler successively on each place of the ship, *c*, *d*, *e*, parallel to the several rumb, and drawing lines, and setting the respective distances thereon, *cd*, *de*, *ef*; you will have *f* the place of the ship at last. And this is called *Pricking the Chart*.

III. *By the Traverse Table.*

Find the difference of latitude and departure for every single course as directed in case 1, plain sailing, either by calculation, or shorter by the traverse table. And observe whether each diff. latitude be north or south, and whether the departure be east or west. And then put all into a table, under their respective columns as follows. Then sum up each column to find the difference between the northing and southing; and likewise between the easting and westing. And by this means you get the difference of latitude and departure. And which way it lies, is known by the greater numbers.

Courses





Courses	Dist.	Northing	South.	Easting	West.
N.N.E.	26	24.	—	9.9	—
N.E.	30	21.2	—	21.2	—
N.	22	22.	—	—	—
E.	24	—	—	24.	—
S.E.	26	—	18.4	18.4	—
		67.2	18.4	73.5	00.
		48.8		72.5	

So the difference of lat. is 48.8 north. And the departure 73.5 east. Which being had, the latitude of the ship is found to be 57.26 ; for 48.8 leagues is 146.4 miles, that is, 2 deg. 26 m. And lastly, the difference of longitude is found by case 4 of Mercator,

P R O P. XXV.

To work a Day's Reckoning.

A Day's reckoning is an exact account of the courses and distances that a ship sails in the space of 24 hours ; that is, from 12 o'clock at noon, till 12 o'clock at noon the next day ; and done after the manner of working a traverse, as in the last prop. The man at the helm is to observe carefully what course he steers ; or to keep close to the proper course appointed. And at the end of two hours, the log is to be heaved, and the knots and tenths run off in half a minute, must be exactly set down against the hour, in the log-board. And after this manner all the courses and distances every two hours are each to be written down on the log-board against

against their respective hours; as in the following figure, which is the form of the log-board.

Here the courses must all be set down as given by the compass, and no allowance is to be made for variation, lee-way, currents, &c. till afterwards,

Ho.	Courses.	Kn.	Winds.	Remarks.	Courses corrected.
2	S.W. by S.	7.1	N.W.	Variation 1 Point W.	S.S.W.
4	—	7.5	W.N.W.		—
6	S.	8.0	W.b.N.		S. by E.
8	—	8.5	W.N.W.		—
10	N.W. by N $\frac{1}{2}$ W.	4.6	S.W.		N.W. $\frac{1}{2}$ W.
12	—	5.3	—		—
2	—	5.4	W.b.S.	1 $\frac{1}{2}$ p. Lee Way A Current setting WNW for 3 hours at 2 miles an hour. 1 P. Lee-Way.	N.W. by N.
4	S.W.	5.5	N.N.W.		S.W. by S.
6	—	8.0	—		—
8	S.E.	4.1	—		S.E. by E.
10	S.W.	4.2	E.S.E.		S.W. by S.
12	E.S.E.	4.1	S.		E.

Then after 24 hours, or the next day at noon, you must correct all the courses by proper allowances for variation and lee-way; which put into a new column. And in case of a current, consider it as a new course of the ship. With all these you must make a new table, in which you must put all these corrected courses with their distances; and for shortness putting all these into one sum, that belong to the same course. This done, you'll have the following table. By this you must find the diff. latitude and departure, by Prop. XXIV. for working a traverse; as you see. And here the traverse table is of particular service; this being its chief use. Then the diff. lat. and departure must be doubled, if the log be only heaved every two hours, as is common.

Courses.

Courses.	Points.	Diff.	N.	S.	E.	W.
S.S.W.	2	14.6	—	13.5	—	5.6
S. by E.	1	16.5	—	16.2	3.2	—
N.W. $\frac{1}{2}$ W.	4 $\frac{1}{2}$	9.9	6.6	—	—	7.3
N.W. by N.	3	5.4	4.5	—	—	3.
S.W. by S.	3	17.7	—	14.7	—	9.8
S.E. by E.	5	4.1	—	2.3	3.4	—
E.	8	4.1	—	—	4.1	—
Current	7	3.0	06	—	—	3.0
W. by N.						
			11.7	46.7	10.7	28.7
				35.0		18.0
				70.0		36.0
	doubled					

Then the diff. latitude being found 70 southerly, and the departure 36 westerly, the latitude of the ship is had; and the difference of longitude must be found by case 4, of Mercator. And then the place of the ship is known; all which must be put down in the journal; and then that day's reckoning is finished.

It is very necessary that you sometimes calculate what course to steer to hit your port; and this is easily done by case 1, Mercator, after you have found what latitude and longitude your ship is in.

Note, if the diff. longitude be found for every particular course, it will be something more exact than finding it all at once, after 24 hours run; especially, if the ship change her latitude much. But then this creates a great deal more trouble.

Note

Note also, the several courses are easily corrected, by laying a thread over the figure of the compass (FIG. 1.) to represent the true meridian; and reckoning your points from that, instead of the magnetic meridian.

P R O P. XXVI.

To correct a Reckoning.

1. Always when opportunity offers take the meridian altitude of the sun or a star. And from thence by Prob. IX. Part. I. find the latitude. And this observed latitude is always to be depended on for true, if it be carefully taken. Then if the observed latitude agree with your latitude by computation, your reckoning requires no correction.

2. If the computed and observed latitudes disagree; examine whether you have made any mistake in allowing for variation or lee-way, or in computing your work; if not, see if you have rightly allowed for currents, according to the former directions: For you ought to be very cautious about currents, tides, and the setting of the sea; for if a strong wind has stood a good while one way; assure yourself a current sets more or less that way; therefore these things ought never to be neglected.

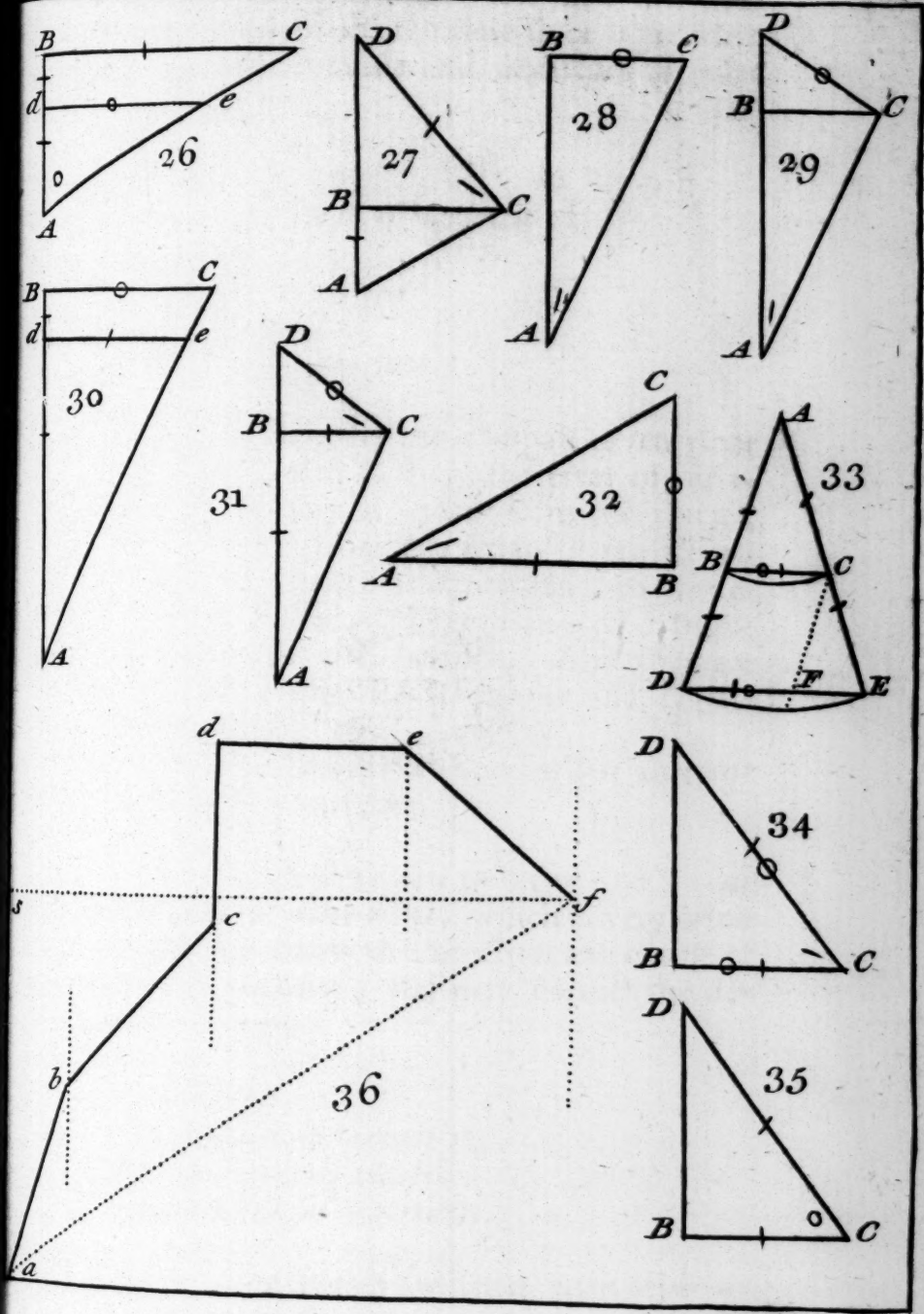
3. At any time when you have opportunity get the variation by Prob. XVI. Part I. by the sun's amplitude or otherwise; and for the future, allow for variation as you find it now. And if the variation before was erroneous, by having the error of variation, you may find the correction in latitude and departure thus. Judge as near as you can how long the variation has been wrong accounted; probably it has altered gradually ever since the last observation

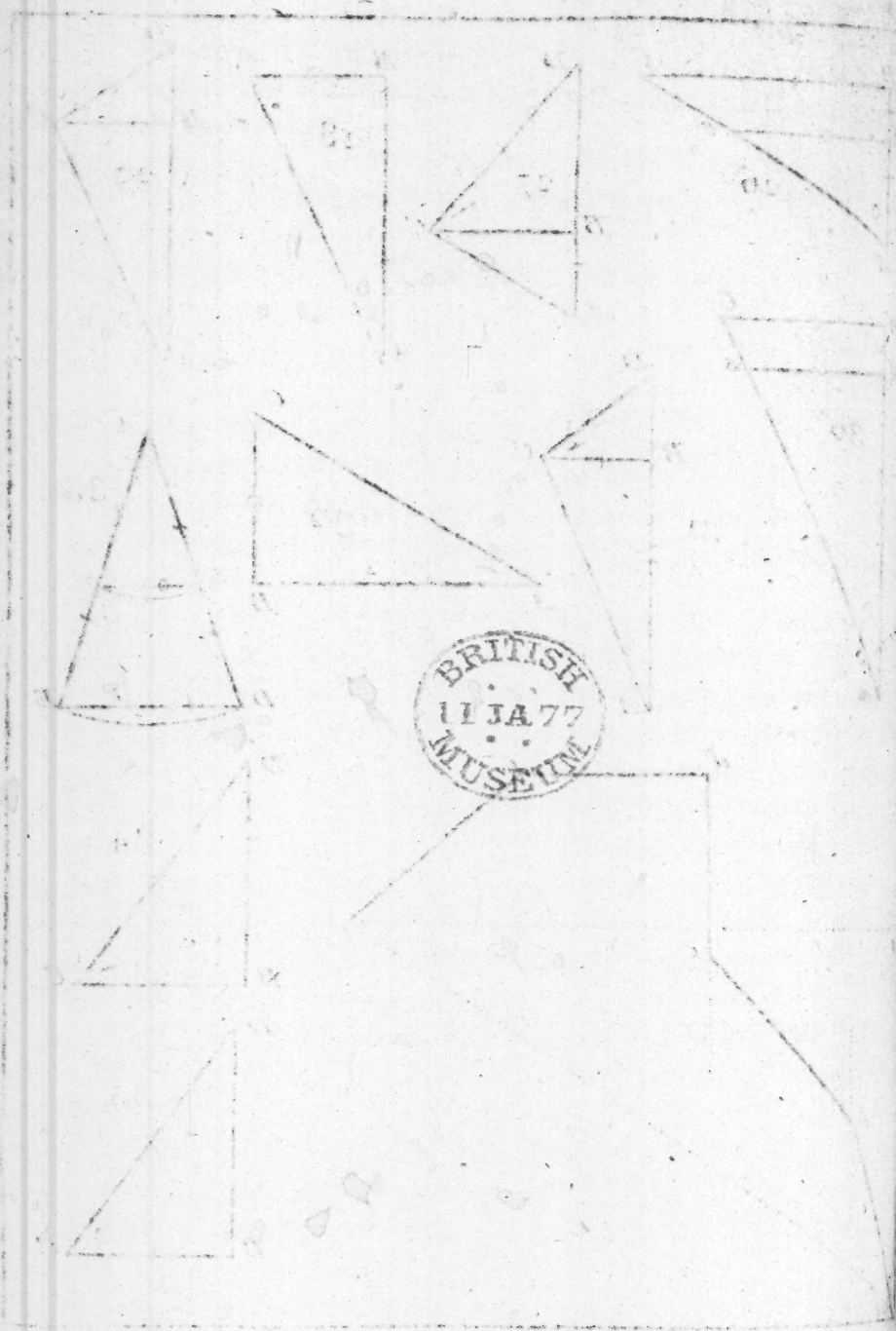
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observation of the amplitude, &c. and therefore you may safely take half the time since that was; then find the diff. latitude and departure for that time, and say,

As Radius :

To sine of the error of variation ::

So departure :

To correction in latitude ::

And so diff. latitude :

To correction in departure.

Then lay a thread over the compass to represent the true meridian, and to show the error of variation; then if the ship is further from this thread, than it was before (from the supposed meridian), the correction of departure is to be added to the departure; but if nearer, the correction of latitude is to be added to the diff. latitude. And they are always contrary; that is, if one be added, the other is subtracted.

This work must always be done when an error is discovered in the variation.

¶ 4. If you have good reason to judge that a current is the cause of your error, which is very often the case, and you know the direction and course of it, but not its quantity; you may correct the departure, by saying,

As Radius :

To correction in latitude ::

So Tan. currents course :

To correction in departure.

Which is to be reckoned the same way (east or west) as the current's motion; then by this, the

G

departure

departure will be corrected to agree with the observed latitude.

5. When none of these things appear to be the cause of your error, and the latitudes cannot be made to agree: Then the error must be either in the course or distance run, and one of them must be corrected, or rather the departure must be corrected upon supposition of one of them being false. Therefore observe whether the ship has out-run the reckoning, or the reckoning has out-run the ship: For the reckoning must always be brought to the ship. Also consider your course from the time of your last observation, whether it has laid nearer the meridian or the east and west; that is, whether the difference of latitude, or the departure be greater. Then,

6. If the diff. latitude be greater than the departure, then it is probable the error is in the distance sailed. Therefore take the difference of latitude and the departure, from the time of the last observation, and say,

As diff. latitude :

To departure ::

So error in latitude :

To correction in departure.

Which is to be added to the departure when the ship is foremost; and subtracted when the reckoning is foremost.

For in this case, the correction of the diff. of latitude and departure are of like kind; that is, if one be added, the other is added; and if one is subtracted, the other is subtracted.

7. But

7. But if your course be nearer the east and west ^{FIG.} than the north and south; or the departure greater than the diff. of latitude, (reckoned from the time of the last observation;) then the error is most likely to be in the course. Then say,

As departure:

To diff. latitude ::

So error in latitude:

To correction in departure.

Which is to be added to the departure, if the reckoning is before the ship; or subtracted when the ship is foremost. For in this case, the correction in latitude and departure are always contrary; when one adds, the other subtracts.

But here if you sail near east or west, you may save the labour of this correction, it is so small.

8. If you sail near 4 points from the meridian, that is, when the diff. latitude and departure are nearly equal; if you suspect either course or distance, correct where you think the error lies. But if you be doubtful, whether of them is the cause of it; correct only the latitude, leaving the departure as it was.

For if they both be faulty, their corrections will be contrary; that is, one adds when the other subtracts; and so destroy one another's effects.

9. For correcting the longitude, having got the correction in departure: Take the meridional difference between the computed and observed latitude; then say,

As error in latitude:

To correction in departure ::

So merid. diff. latitude:

To correction in longitude.

Which is to lie the same way (east or west) as the correction of departure does.

10. The error in the distance may arise from the log, or the inaccurate measuring the way of the ship by it; for generally speaking the ship's way is greater than that given by the log; especially if a great sea sets after her. In this case, 'tis usual to allow one mile in ten, or less when the sea is less. And the contrary will happen if a sea be against the ship: For then the ship's way may be less than the distance measured by the log. The time and setting of the tides must also be carefully considered.

All or most of these things about correcting the departure, are only suppositions, and depend mostly upon the judgment of the artist, but tho' not infallible, are the only means afforded for making these corrections.

11. When several ships sail upon the same voyage, the coincidence or concurrence of their reckonings will confirm them; and their disagreement may help to correct them all. And if you can get an account from any ships you meet, what longitude and latitude they suppose they are in, you may compare that with your own account. Which perhaps may give you some light how to correct it.

S C H O L.

If the much desired method of finding the longitude by some observation or other, could ever be found out (which I doubt never will); then there would be no need of this proposition. For as by an observation of the sun or a star the latitude is known. So by some like observation would the longitude be known. But this has hitherto proved a task insuperable.

The

PART II. TO KEEP A JOURNAL. 125

The corrections here given suppose that there is not an error in both course and distance. And yet 'tis equally probable there may be in both as well as in one. Now if it happens that one of them nearly balances the other, as to latitude; then we cannot be sensible of any error; and yet in this case there must be an error in the longitude; tho' there is no possible way to discover it. Again, if they both tend one way, or make a considerable diff. in the latitude, yet they may make little in the longitude: And yet we are obliged to correct the longitude in proportion to the latitude, tho' perhaps it needed none. But here I ought to observe, that there are many persons who correct neither the departure nor the longitude, on account of the uncertainties that attend them; but retain them as computed, and correct only the latitude.

P R O P. XXVII.

To keep a Journal or Sea Reckoning.

The keeping a journal, is a punctual writing down in a book called the Journal Book; the courses, distances, diff. latitude, and departure the ship makes every day; and what latitude and longitude she is in; and also the weather, and all remarks; and must contain every day's reckoning as found by Prop. XXV.

1. This book must be a quarto of two or three quire of paper or more, according to the length of the voyage. Each page must be ruled into columns, of a sufficient depth, the same as you have on the log-board, in Prop. XXVI. and one towards the right hand, in which the corrected courses are to be put. The first column is for hours numbered 2, 4, 6, &c, for common voyages; and 1, 2, 3,

&c. for East-India voyages, which therefore must be made deeper. The second column is for the courses. The third for the knots or distances run in an hour. The fourth winds. The 5th must be large, it contains remarks, such as the transactions of that day, as winds, weather, currents, setting of the sea, handing of sails, meeting or parting with ships, death of men, variation of the compass, and all other accidents and occurrences whatever; particularly the sun's altitude, declination, lat. by observation, true and magnetical amplitude and variation. To these you must add a sixth column for the courses corrected.

The title of the journal must declare the latitude and longitude of the place sailed from, and also the latitude and longitude of the place sailed to, or of the first place you come at, if you sail to several. And the course and distance from one to the other; to be found by case 1, Mercator; and case 2, plain sailing.

2. Below these you must have other columns ruled, in form of a traverse, as in Proposition XXIV. into this you must put the corrected courses, points, distances, northing, southing, easting, and westing, as found by Prop. XXV. I would put this into the journal, because, when any mistake happens, it may easily be examined and corrected. And it takes but little room, for out at sea in long voyages, the winds are not so variable as near land, and a ship has no occasion to alter her course so often. But if any one chuses rather to leave it out, he must be very correct in finding the diff. latitude and departure.

3. Near the bottom you must make other short columns; in these are to be put the northing, southing,

PART. II. TO KEEP A JOURNAL. 127

southing, easting, and westing; the latitude and longitude, first by account, and then corrected; all which may be seen in the following pages. Your book must be made and ruled before you go to sea, and then it will be ready for use; which being done, every page will contain a day's reckoning.

But instead of putting the remarks into a column on the left hand side, you may allow the whole page on the right hand for them, if you please; and then you will have but one day's work in a leaf. Or you may contrive any other method of keeping a journal, provided it be commodious and short; and so that you can but understand it clearly yourself; for different men will have different methods. But the shortest method is the best, provided it be equally true and plain.

4. When you go out to sea, you must first find the course to be steered by the compass: This is easily done, having the true course and variation given. Lay a thread over the compass to represent the true meridian, and from this reckon as many points as your true course is; where that falls, is the course by the compass.

At parting with the sight of your port (or the place you take your departure from); take its bearing, and then the opposite point is the course you have sailed; and the distance from it, you must either measure with the log, or take by estimation; with these you must begin your first day's work. Many people take their departure from the last known land they can see.

Then you must at the end of every two hours, write over against it, upon the log-board, the course steered, and the distance run, for that two hours, with other remarks; and this work must

TO KEEP A JOURNAL.

be continued till the day is out ; and likewise every day from moon to moon.

Every day at noon write into the journal book the same you find written on the log-board. And then you must work up your day's reckoning according to the directions of Prop. XXV. which you must write into the columns below ; if you chuse to insert them in the book.

5. Having thus got the diff. latitude and departure, and lat. and long. put them into their respective columns at the bottom of the page, against the title (*by account*). Take care to get an observation of the sun or a star as often as you can, and from thence find the latitude by Prop. IX. Part I. And from this, correct the place of the ship by Prop. XXVI. And put these corrected diff. lat. departure, latitude and longitude, into the columns at bottom against the title (*corrected*). Also as oft as you can, take an observation to obtain the variation, by Prop. XVI. Part I. After this manner you are to proceed every day from noon to noon, till the voyage be finished. And you must be sure to look out for land some days before you expect, by your reckoning, to be at it.

The following is an Example of three days run, where the lat. long. and departure is reckoned from the Lizard.

Example.

In the following form of a Journal. In the first day Ap. 20, where you have a point variation, all the courses, when corrected, will differ a point ; and besides, where you have $1\frac{1}{2}$ point leeway, a N. W. by N. $\frac{1}{2}$ W. course becomes a N. W. by N. and 1 point lee-way reduces an
E. S. E.

PART. II. TO KEEP A JOURNAL. 129

E. S. E. course to an E. Also as there is a current setting W. N. W. this is considered as a W. by N. course, after allowing for variation; all which see in the fig. or table below it; from whence you get the diff. lat. 70, departure 36; and therefore the lat. 48 45, and longitude 12 01, found by Prop. XXV. All these you have *by account*, as placed at the foot of the page; but none corrected for want of an observation.

In the second day, April 21, we get the sun's amplitude at setting; and the next day his meridian altitude. And finishing that day's reckoning by Prop. XXV. we get the latitude 47 31, longitude 8 58, as below *by account*. But from the sun's declination 12 17, we get (by Prob. IX. Part I.) the latitude 47 54: So that we are short of our reckoning 23 miles south. Now, at the time of taking the amplitude, reckoning the lat. about 48 : 40, and declination 12 : 2, we get the sun's true amplitude 18 24 (by Prob. 4.), and from this (by Prob. 16.) we find the variation, which is 7 : 16. So now I see we have allowed too much variation, and therefore the fault must be supposed in the course. Proceeding then by Prop. XXVI. Art. 7. I find the correction in departure 21, and in longitude 30; whence we get the latitude and longitude corrected; the latitude 47 54, and longitude 8 28. And the like for the third day, or any other day's reckoning.

A
JOURNAL
Of a VOYAGE
IN THE
SWEEPSTAKES,

From the LIZARD Lat. 49 55 N. Lon. 12 56.
to JAMAICA Lat. 18 0 N. Long. 301 7.
In the Year 1754.

The Course S. 61 13 W.
Distance 3977 Miles.
A. B. Master. Kept by C. D. Mate.

A JOURNAL.

Monday April 20th, 1754.

Hours.	Courses.	Knots.	Winds.
2	S.W.b.S.	7.1	N.W.
4	—	7.5	W.N.W.
6	S.	8.0	W.b.N.
8	—	8.5	W.N.W.
10	N.W.b.N. $\frac{1}{2}$ W.	4.6	S.W.
12	—	5.3	—
2	—	5.4	W.b. S.
4	S.W.	5.5	W.b. N.
6	—	8.0	N.N.W.
8	S.E.	4.1	—
10	S.W.	4.2	E.S.E.
12	E.S.E.	4.1	S.

Courses.	Poi.	Dist.	Nor.	Sou.	East.	West.
S.S.W.	2	14.6	—	13.5	—	5.6
S.b.E.	1	16.5	—	16.2	3.2	—
N.W. $\frac{1}{2}$ W.	4 $\frac{1}{2}$	9.9	6.6	—	—	7.3
N.W.b.N.	3	5.4	4.5	—	—	3.0
S.W.b.S.	3	17.7	—	14.7	—	9.8
S.E.b.E.	5	4.1	—	2.3	3.4	—
E.	8	4.1	—	—	4.1	—
Currents } W.b.N. }	7	3.0	0.6	—	—	3.0
			11.7	46.7	10.7	28.7
				34.0		18.0
		doubled		70.0		36.0

Remarks.

Remarks.	Courses corrected
Variation 1 point W.	S.S.W.
Fair brisk gale	—
Lost sight of the Lizard at 7, bearing NbE $\frac{1}{2}$ E.	S.b.E.
Past by the (Phoenix) to the Westward.	—
	N.W. $\frac{1}{2}$ W
	—
1 $\frac{1}{2}$ point lee-way	N.W.b.N
	S.W.b.S.
	—
A Current setting W.N.W. for 3 hours, at 2 miles an hour.	S.E.b.E.
1 point lee-way:	S.W.b.S.
	E.

April 21,	North.	South.	East.	West	Lat.	Long.
By account	—	70.0		36.0	48 : 45	12 : 01
Corrected.						

Tuesday

A JOURNAL

Tuesday, April 21.

Hours.	Courses.	Knots.	Winds.
2	W.b. S.	3.0	E.b.S.
4	—	3.0	N.E.b.E.
6	—	3.5	—
8	—	5.1	—
10	—	6.0	—
12	W.S.W.	7.3	N.E.
2	—	7.3	—
4	—	7.0	N.E.b.N.
6	—	10.0	—
8	—	8.3	—
10	—	6.3	N.b.E.
12	S.W.b.W	4.9	—

Courses.	Poi.	Distance.	Nor.	South.	East.	West.
W. S. W.	6	20.6	—	7.8	—	19.1
SW.b.W.	5	46.2	—	25.7	—	38.5
S. W	4	4.9	—	3.4	—	3.4
				36.9		61.0
		doubled	—	73.8		122.0

Remarks

Remarks.	Courses. corrected
1 Point variation W.	W. S. W.
Sun's amplit. obs. 25 40.	—
Saw a fail to the N.N.E standing S.E.	—
Snow and rain.	S.W.b.W
Top fails reev'd	—
Hard gale	—
Rain	—
Clear again	—
Sun's mer. alt. 54 23 observ'd.	S.W.

April 22	North.	South.	East.	West.	Lat.	Long.
By account		73.8		122.0	47:31	8 58
Corrected		50.8		143.0	47:54	8 28

Wednesday

Wednesday, April 22,

Hours.	Courses.	Knots.	Winds.
2	—	0	W.
4	—	0	
6	S. b. W.	1.0	
8	—	1.2	
10	—	1.5	
12	—	2.0	
2	—	2.4	S.W.
4	S.	3.1	
6	—	3.1	
8	—	3.0	
10	—	3.4	
12	—	3.4	

Courses.	Points.	Distance.	Nor.	South.	East.	West.
S. $\frac{3}{4}$ E.	$\frac{3}{4}$	8.1		8.0	1.2	
S.S.E. $\frac{1}{4}$ E.	$2\frac{1}{4}$	60.0		14.5	6.9	
				22.5	8.1	
		doubled		45.0	16.2	

Remarks

Remarks.	Courses corrected
Variation 9d. W.	—
No wind, fair weather. A smooth sea.	—
Lee-way 1 point, all this Course	S. $\frac{3}{4}$ E.
	—
	—
	—
	—
	—
Lee-way 1 $\frac{1}{2}$ point, all this Course	S. S. E. $\frac{1}{4}$ E
	—
	—
	—
	—
	—

Apr. 23	Nor.	South.	East.	West	Lat.	Long.
By account		45.0	16.2		47 : 9	8 52
Corrected.						

An

An Alphabetical TABLE of Sea Terms.

A

A B A F T or *Aft*. Backwards, behind, towards the stern.

Aboard. In the ship.

Aloft. On high.

Aloof. At a distance; falling from the wind.

Amain. All at once.

Avast. Stop, hold.

B

to *Bale*. To empty water with buckets.

Beacons. Fires or lights on the sea coast, to prevent ship-wreck, invasion, &c.

to *Bear in*. To sail towards.

to *Bear off*. To keep off; to thrust off.

to *Bear up*. To keep more into the wind.

Becalmed. Wanting wind.

to *Belay*. To fasten a running rope after it is haled; which is done by folding it several times about some timber head, &c.

to *Bend*. To bind; to fasten.

Berth. A convenient place, and distance to moor in.

Bight. Any part of a rope as it is coiled up.

on *Board*. In the ship.

Bulged. Staved; broke in.

Bunt. The bag of a sail.

By a Wind. Near the wind; or as near against it as possible.

C

Captain. The commander of a ship, having a commission.

Close

PART. II. A TABLE of SEA TERMS. 139

Close. Near to.

to *Cond.* To direct the man at the helm how to steer.

Crank. Apt to lie aside, or turn over.

to *Cun.* To direct the steering.

D

Dead Reckoning. The ship's reckoning by the Journal.

Dead Ropes. Those which run not in blocks.

Dead Water. The eddy at the stern of the ship.

to *Drive.* To fall away with the wind or tide.

E

to *Ease.* To slacken.

End for end. When a rope is all run out.

Eow. All pull together.

F

Fack or *Fake.* One circle of a rope coiled up.
the *Fall.* That part of a rope which is pulled at.

to *Fall off.* To go further from the wind.

to *Fend.* To defend; to thrust off.

to let *Fly.* To let go.

Fore and aft. Along the ship, from head to stern.

Foul. When a rope is so intangled, that it cannot run.

Foundered. Sunk, by taking in water.

Fraight or *Freight.* The Burthen of Goods a ship carries.

to *Furl.* To bind up close.

G

to *Gripe.* To run too much into the wind.

to

to *Gull*. To Gall, to eat or wear.

H.

Handspike. A wooden leaver, to heave with.
to *Hâle*. To pull at a rope.

to *Hail*. To call at ; as *Ho, the ship*.

Head sea. A great sea meeting the ship a-head.
to *Heel*. To lie or lean to one side.

to *Hitch*. To catch a thing with a rope or hook.

to *Hoist*. To hâle up.

Home. Comes toward you.

I

Ironfick. When the nails and bolts are eaten away with rust.

K

A *Kenk*. A small turn or snarle, on a rope.

L

Larboard. The left side of the ship, as a man looks forward.

Large wind. When a ship goes almost before the wind, or when the wind comes on the quarters ; that is, makes half a right angle or more with her way.

to *Lasb*. To bind any thing to the ship sides, &c.

Lasking wind. A large wind.

to *lay the Land*. To get without sight of land.

Lee. Fromwards the wind.

Lee shore. The shore on which the wind blows.

Leeward. From the wind ; or the place towards which the winds blows.

Loof

PART.II. A TABLE of SEA TERMS. 141

Loof up. Keep near the wind.
to *Loom.* To appear.
Luff. Loof.

M

to *Moor.* To lie at anchor, by help of two anchors,
&c.

N

Neaped. A ship is neaped, when the tides are so small as not to carry her out.
Near the Wind. This is when a ship sails with her head almost against the wind, or as near as she can come. This is also called, *by a wind, or upon a wind.*
No near. Come no nearer the wind, but keep more to leeward.

O

Offing. The part of the sea at a good distance from the land.
to *Overhâle.* to hâle back.
Overfet, Turned over.

P

a *Peek.* Right under; across.
to *Pitch.* To sail with the ship's head in and out of the sea, so as to endanger the masts; to toss forward and backward.
Port. The left or larboard side. A haven.
to *Purchase.* To gain, or bring in.

Q

Quarters. The back parts of the ship, adjoining to the steerage.

Quarter

Quarter Watch. When only a quarter of the company watches.

Quarter Winds. Are those which come upon the quarters, or make about half a right angle with the keel.

to *Quoil.* To lay the fakes of a rope round about, upon one another.

R

a *Reach.* The distance between two turnings of a river.

to *Reeve.* To put through.

to *Ride.* To be kept in one place by an anchor, or anchors.

Right the Helm. Put it streight; or to neither side.

Rise the Tack. Slacken it.

a *Road.* A place where a ship may ride at anchor near the land.

S

to *Seaze.* To make fast; to bind together.

Seeling. Rocking from one side to the other.

to *Send.* To fall with the head or stern into the trough of the sea.

Sheering. When a ship goes not steady, but in and out.

Slatch. The part of a rope that bags or hangs loose.

a *Spell.* Any one's turn to labour.

to *Splice.* To make the ends of ropes fast together, by working the strands into one another.

Spooning. Putting a ship right before the wind and sea, without any fail, in a storm.

to *Spring.* To crack.

Standing

PART.II. A TABLE of SEA TERMS. 143

Standing ropes. Such as run not in blocks.

Starboard. The right side of the ship, when you look forward.

Steady. Keep the helm at rest.

to *Stow.* To put goods into a ship in proper order.

Strap. The rope spliced about a block, commonly with an eye.

to *Strike.* To let fall the sails; to beat on the ground.

T

to *Tack about.* To bring a ship about, so that her head may lie as much to the right hand of the wind, as it did before to the left: and the contrary.

under a *Tack.* When she sails close by a wind, or near the wind.

Tacks aboard. When the starboard tack is aboard, the starboard side of the sail is haled forward by the *Tack*; and the larboard side, backwards by the *Sheet*: And then the wind comes on the starboard side of the ship: And she makes her way to the left hand of the point the wind blows from, or to the right of the direct way of the wind. And on the contrary, when the larboard tack is aboard, the wind comes on the larboard side.

Taunt Mast. A high mast in proportion for the ship.

Taught. Tight, stiff, fast.

Thus, Thus. When the ship is right steer'd.

Tide and half Tide. A tide three hours longer or later.

Tight. Water proof.

to *Tow.* To drag after the ship.

Trim. The posture or position the sails best in.

Trough

A TABLE of SEA TERMS.

Trough of the Sea. The hollow between two waves.

Try. To go under the main sail, or mizen sail, only.

V

to *Veer out.* To let a rope run out.

Veering. Sailing large.

W

Wake. The smooth, white, frothy water, a-stern of the ship; running out to a good distance. This shows the way the ship has sail'd.

Walt. Wanting ballast.

to *Warp.* To hale a ship to any place with a hawser, when the wind is wanting.

Watch. Half the ship's company, which keeps watch for four hours at sea.

to *Weather.* To get to windward.

Weather Bow, Weather Side, &c. That next the weather or wind.

Weather Shore. That from whence the wind comes.

Wending. Turning about, when lying at anchor.

to *Wind.* To bring the ship's head about.

Windward. That part from whence the wind comes; and opposite to the leeward.

A *Windward-Tide.* That which goes with the wind.

a *Wreck.* A ship cast up, that perish'd at sea.

Y

Yare, Nimble, ready, quick.
to *Yaw*. To go in and out, or to the right and left, with the head.



H

An

Y

*An Alphabetical Table of the most remarkable Seaports,
Capes, Islands, Straits, Gulfs, Bays, Harbours,
Rocks, River-Mouths, in the World; with the La-
titude and Longitude, counted from the Meridian of
the westermost of the Canary Islands.*

Note, I. stands for Isle; B. for Bay.

A.

	Latitude		Long	
	D.	M.	D.	M.
A BACCO I.	26	30 N	300	5
Abdeleur I.	2	10 N	72	34
Aberdeen	57	24 N	16	32
Abou	60	40 N	39	20
Abrollo I.	21	20 N	309	30
Admiralty I.	75	5 N	78	0
Agalega I.	9	37 S	73	21
Alboran I.	36	10 N	15	40
Alderney I.	49	16 N	16	15
Alexandria	31	7 N	49	0
Algiers	36	40 N	21	15
Alicant	38	35 N	17	50
Alligrama I.	28	55 N	5	25
Amboina	3	50 S	149	20
Ameland I.	53	30 N	26	30
Amsteldam I.	38	20 S	92	34
Amsterdam	52	21 N	23	0
Anain I.	19	42 N	114	45
Ancona	43	31 N	32	50
Andaman I.	13	0 N	109	35
Andreo I.	12	12 N	297	52
Androfs I.	24	40 N	299	10
Anegada I.	18	47 N	315	26
Angola	8	51 S	34	6
			Anguilla I.	

LATITUDE and LONGITUDE.

147

ports,
bours,
the La-
idian of

Long
D. M.
00 5
72 34
16 33
39 20
09 30
78 0
73 21
5 40
6 15
9 0
1 15
7 50
5 25
9 20
6 30
2 34
3 0
4 45
2 50
9 35
7 52
9 10
5 26
4 6
1 1

Anguilla I. _____
Annabona I. _____
Anout I. _____
Antegá I. _____
Articofti I. _____
Antilles If. _____
Antiochetta _____
Antiochia _____
Antwerp _____
Aquapulco _____
Aquatulco _____
Archangel bar _____
Arensburg _____
Arian If. _____
Arica _____
Aruba I. _____
Ascension I. _____
Afinora I. _____
Affafins B. _____
Affene _____
Athens _____
Atkins Key I. _____
Atwoods Key's If. _____
Azore If. _____

B.

Baffin's B. _____
Bahama Bank, N. point _____
Bahama If. _____
Bajona If. _____
Baldivia _____
Ballafore _____
Bamf _____
Banca I. _____
Bandy I. _____
Bantan I. _____
Barbadoes I. _____

H 2

Latitude.		Long.	
D.	M.	D. M.	
18	13 N	315	15
1	42 S	25	0
56	44 N	29	8
17	0 N	316	00
47	35 N	317	25
15	0 N	308	0
36	40 N	49	47
35	54 N	56	30
51	10 N	22	30
17	0 N	273	42
15	27 N	277	7
65	5 N	56	40
58	0 N	41	40
54	55 N	8	20
18	12 S	304	0
12	50 N	309	42
8	10 S	2	35
41	0 N	27	40
40	0 S	191	0
4	15 N	17	10
38	0 N	42	20
22	30 N	303	55
23	9 N	304	40
39	0 N	350	0
66	0 N	255	0
28	22 N	299	55
26	40 N	298	12
42	22 N	8	46
39	35 S	296	50
21	20 N	104	30
57	50 N	16	25
3	0 S	124	00
5	5 S	144	47
5	47 S	123	21
13	26 N	318	7
Barbuda I.			

A TABLE OF

	Latitude.		Long.	
	D.	M.	D. M.	
Barbuda I.	17	43 N	316	45
Barcelona	41	30 N	20	30
Barazar point	66	30 N	6	30
Barley I.	52	46 N	13	12
Bass I.	48	0 N	14	40
Bassos de Chagos I.	5	5 S	88	35
Batavia I.	6	20 S	125	00
Bayonne	43	30 N	16	40
Beachy	50	48 N	18	35
Beerenberg I.	71	45 N	22	40
Bell I. (America)	52	5 N	323	0
Bell I. (France)	47	20 N	15	0
Bell Sound	77	15 N	30	50
Belfast	54	36 N	11	32
Bencola I.	3	50 S	119	23
Bengal	22	07 N	110	0
Bergen	60	50 N	25	15
Berlin	52	32 N	31	20
Bermudas I.	32	30 N	313	40
Berwick	55	50 N	16	31
Bieque I.	18	0 N	314	55
Bilboa	43	30 N	15	10
Biscay B.	45	0 N	16	0
Black point S. End	78	0 N	28	40
Block I.	41	7 N	308	20
Bologne	50	45 N	19	35
Bona	37	0 N	25	10
Bonair I.	12	22 N	311	12
Bonaventuro B.	3	28 N	298	4
Bonavista I.	16	5 N	355	47
Borgo	60	40 N	44	26
Borneo I.	1	32 N	131	0
Bornholm	55	15 N	33	3
Boston (New England)	42	25 N	308	20
Bordeaux	44	50 N	17	46
Brava I.	14	35 N	353	4
Breda	51	30 N	23	15
Bremen	53	50 N	27	10

Breslaw

LATITUDE and LONGITUDE. 249

	Latitude.		Long.	
	D.	M.	D.	M.
Breslaw	51	3 N	34	55
Brest	48	23 N	13	26
Brill	51	56 N	22	20
Bristol	51	32 N	15	35
British If.	53	0 N	15	0
Buchanefs	57	55 N	16	50
Buenos Aires	34	35 S	319	40
Bull's B.	47	40 N	326	32
Burlings	39	39 N	8	40
Bussera	30	0 N	67	15
Button's B.	66	0 N	255	0
Button's If.	60	5 N	311	20
C.				
Cabos I.	0	40 S	29	46
Cadiz	36	31 N	11	50
Cairo	30	5 N	49	30
Calais	50	57 N	19	40
Caldy I.	51	33 N	12	56
Calecut	11	17 N	93	4
Calmer	56	45 N	34	45
Camanes If.	19	0 N	297	10
Camarica B.	48	25 N	13	42
Camose	65	43 N	53	24
Campeche	19	20 N	283	5
Canary If.	27	56 N	2	0
Cancrofs bank N. point	20	50 N	306	55
Candy I.	35	22 N	43	19
Canea	35	30 N	42	22
Cantam	23	20 N	131	30
Cape Verd. If.	18	0 N	355	0
Cape Avalilla	12	10 N	127	13
— Bajador	26	12 N	2	50
— Barbador	39	0 N	46	0
— Barbernola	38	35 N	46	5
— Barcan	78	25 N	40	21
— Bassos	4	0 N	63	0
— Blanco (America)	46	50 S	306	5

H 3

Cape

A TABLE OF

	Latitude.		Long.	
	D.	M.	D.	M.
Cape Blanco (Africa)	20	35 N	1	15
— Bona	37	5 N	28	10
— Bonavista	49	20 N	325	7
— Breton	46	20 N	319	50
— Candinose	69	27 N	60	40
— Cantin	32	36 N	8	50
— Catacho	21	12 N	287	15
— Charles	62	35 N	302	50
— Charles	37	14 N	303	55
— Churchill	59	0 N	284	0
— Cipige	42	0 S	190	0
— Clear	51	10 N	7	40
— Cod	42	10 N	310	25
— Cold	79	55 N	28	10
— Colona	37	30 N	43	34
— Comerine	7	58 N	94	35
— Coquibaca	12	50 N	307	30
— Corientes (Africa)	23	52 S	53	45
— Corientes (America)	19	00 N	267	40
— Corfe	4	40 N	20	34
— De Gat	36	40 N	16	25
— De Geer	30	20 N	8	0
— De Hogue	49	46 N	15	48
— Del Ajuga	6	38 S	292	20
— Del Gado	10	0 S	58	0
— De St. Andrews	38	50 S	314	55
— De tres forcas	35	34 N	16	44
— Desolation	62	0 N	335	0
— Elizabeth	62	2 N	311	20
— Fair	34	0 N	300	0
— Falso	9	0 S	57	0
— Farewell	59	30 N	331	25
— Finister	43	6 N	8	10
— Florida	24	46 N	296	15
— Formosa	4	00 N	24	40
— Frio	22	52 S	335	15
— Gallo de Zelone	6	7 N	98	55
— Glado	25	50 N	81	44

Cape

LATITUDE and LONGITUDE. 151

		Latitude.		Long.	
		D.	M.	D.	M.
Cape of Good Hope	—	34	05 S	35	00
— Guardufoy	—	11	50 N	68	40
— Hatteras	—	35	10 N	303	45
— Henrietta Maria	—	55	6 N	294	8
— Henry	—	37	0 N	303	40
— Hinlopen	—	39	4 N	304	45
— Hogue	—	49	46 N	16	4
— Honduras	—	16	25 N	290	20
— Horn	—	57	58 S	298	15
— Jones	—	55	3 N	299	55
— Lagulias	—	35	35 S	36	58
— Iopas	—	1	05 S	28	0
— Malacca	—	20	25 N	121	30
— Martello	—	38	0 N	43	55
— Martin	—	38	45 N	18	38
— Matapan	—	36	35 N	40	30
— Matricaria	—	15	23 N	70	20
— May	—	39	15 N	304	31
— Miserato	—	32	43 N	34	33
— Monte	—	6	23 N	5	40
— Monte Sancto	—	40	5 N	44	15
— Muca	—	23	56 N	76	20
— Nassau	—	8	05 N	320	15
— Negrais	—	26	23 N	111	15
— Negro	—	16	8 S	31	40
— Non	—	28	52 N	6	40
— Olerado	—	23	41 N	2	20
— Orange	—	4	5 N	326	45
— Ortegál	—	44	2 N	10	30
— Palmaris	—	20	45 N	106	20
— Palmo	—	4	3 N	11	00
— Passero	—	36	48 N	34	14
— Paul	—	37	58 N	17	48
— Pinas	—	44	00 N	12	10
— Race	—	46	50 N	325	45
— Roque	—	5	0 S	342	18
— Rosulgat	—	22	27 N	78	55
— Ray	—	48	00 N	320	00

A TABLE OF

		Latitude.		Long.	
		D.	M.	D. M.	
Cape Roxo	---	12	0 N	2 10	
--- Rufato	--- --	33	15 N	39 45	
--- Sable	---	43	45 N	313 45	
--- Saint Angelo	---	36	41 N	41 30	
--- St. Antonia	---	21	50 N	291 38	
--- St. Augustine	---	8	25 S	342 32	
--- St. John (Candy)	---	35	20 N	41 37	
--- St. John (America)	---	50	9 N	324 35	
--- St. Lucas	---	23	25 N	266 14	
--- St. Mary (Italy)	---	39	00 N	37 10	
--- St. Mary (America)	---	94	30 N	321 50	
--- St. Sebastian	---	42	40 N	248 15	
--- St. Thomas	---	24	10 S	32 33	
--- St. Vincent	---	37	0 N	8 38	
--- Sapienza	---	37	10 N	40 0	
--- Sardini	---	35	35 N	46 50	
--- Spartavento	---	38	0 N	35 8	
--- Spatel	---	35	46 N	12 15	
--- Solomon	---	35	25 N	44 40	
--- Southampton	---	61	57 N	299 40	
--- Tenes	---	36	30 N	19 55	
--- Three points	---	4	13 N	15 45	
--- Tidelles	---	37	4 N	23 10	
--- Trefalgar	---	36	10 N	11 40	
--- Verd	---	14	43 N	0 0	
--- Victory	---	52	15 S	294 50	
--- Virgins	---	9	0 N	4 0	
--- Virgin Mary	---	52	0 S	303 5	
--- Walsingham	---	63	5 N	300 30	
Caperwick	---	59	20 N	28 20	
Capria I.	---	43	6 N	27 50	
Caragoli	---	19	30 N	3 20	
Caribbee If.	---	16	0 N	318 0	
Carlisle	---	54	45 N	14 45	
Cartagena (Europe)	---	37	30 N	16 55	
Cartagena (America)	---	10	26 N	302 34	
Carthage	---	35	0 N	29 30	
Caskets	---	49	50 N	15 38	Cat

LATITUDE and LONGITUDE.

153

		Latitude.		Long.	
		D.	M.	D. M.	
		24	25 N	302	50
Cat I.	—	58	37 N	12	0
Cathness	—	42	40 N	38	40
Cattaro	—	5	0 N	324	25
Cayenna I.	—	2	20 S	137	40
Celebes I.	—	35	50 N	13	10
Ceuta	—	6	30 N	100	0
Ceylon I.	—	78	0 N	32	0
Charles I.	—	33	00 N	299	20
Charles Town	—	38	15 N	40	0
Chefalonias I.	—	74	35 N	36	15
Cherry I.	—	42	0 S	308	0
Chiloe I.	—	59	10 N	27	55
Christiana	—	56	00 N	33	0
Christiansstadt	—	30	38 N	138	45
Chusan Is.	—	12	30 S	304	40
Cima	—	42	10 N	30	13
Civitavechia	—	9	58 N	94	00
Cochin	—	14	10 N	109	12
Cocos I.	—	55	20 N	16	55
Coket I.	—	7	7 N	97	15
Columba	—	11	50 S	61	55
Comero I.	—	10	0 S	63	0
Commora Is.	—	47	53 N	325	0
Conception B.	—	54	30 N	39	00
Coningsberg	—	41	7 N	46	40
Constantinople	—	41	30 N	43	40
Contessa	—	55	41 N	30	35
Copenhagen	—	39	45 N	38	52
Corfu I.	—	51	49 N	8	40
Cork	—	42	0 N	27	55
Corfica I.	—	40	5 N	348	15
Corvo I.	—	10	0 S	68	55
Cosmelodo I.	—	51	22 N	7	34
Cow and Calf	—	53	10 N	19	15
Cromer	—	22	30 N	304	10
Crooked I.	—	66	31 N	54	43
Cross I.	—	72	0 N	71	22
Cross point	—	22	0 N	299	0
Cuba I.	—				

H 5

the

A TABLE OF

		Latitude.		Long.
		D.	M.	D. M.
the Cubbs	—	54	18 N	295 20
Curaço I.	—	12	40 N	309 55
Cyprus I.	—	35	28 N	51 10
D				
Dabul	—	18	3 N	92 10
Dago I.	—	59	0 N	41 10
Dantzick	—	54	22 N	36 30
Dartmouth	—	50	27 N	14 34
Dearfound	—	79	15 N	30 50
Defar	—	17	0 N	71 45
Delft	—	52	10 N	22 30
Deman	—	20	6 N	91 40
Dermemel	—	55	48 N	39 46
Derwinda	—	57	20 N	40 10
Dewpoint	—	15	50 N	100 15
Diep	—	49	56 N	19 04
Dieuhead	—	20	42 N	87 40
Dieu I.	—	46	40 N	15 55
Digo gratiosa I.	—	8	42 S	87 15
Digo Roys I.	—	19	45 S	79 45
Domeneſs	—	57	30 N	42 10
Dominico I.	—	15	35 N	317 00
Dort	—	51	45 N	23 0
Dover	—	51	15 N	19 28
Downs	—	51	25 N	19 31
Drakes B.	—	38	16 N	248 20
Drontem	—	63	30 N	28 40
Dublin	—	53	14 N	11 4
Dumfriſe	—	55	28 N	14 40
Dundee	—	56	30 N	15 34
Dunkirk	—	51	0 N	20 30
Dunnoſe	—	50	38 N	16 47
Durazzo	—	41	40 N	38 30
E				
Edinburgh	—	55	57 N	15 24
Ediſtone	—	50	12 N	13 50
				Elbia

LATITUDE and LONGITUDE. 155

			Latitude.		Long.	
			D.	M.	D.	M.
Elbin	—	—	54	20 N	39	10
Elfsingberg	—	—	56	0 N	31	10
Elfinor	—	—	56	10 N	30	42
Emden	—	—	53	5 N	26	10
Enchuycen	—	—	52	50 N	23	15
Engano I.	—	—	5	40 S	119	3
Ephesus	—	—	37	4 N	45	25
Escondite	—	—	18	20 N	279	10
Exuma	—	—	23	25 N	302	13
F						
Fairforeland I.	—	—	55	5 N	11	40
Fair I.	—	—	59	30 N	14	50
Faro Sound	—	—	58	3 N	37	0
Farrahead	—	—	58	50 N	13	5
Fermo	—	—	43	10 N	15	30
Fernando I.	—	—	2	40 N	28	30
Fero If.	—	—	62	6 N	12	42
Ferro I.	—	—	27	50 N	0	0
Final	—	—	44	10 N	27	0
Fisher's I.	—	—	70	0 N	44	48
Fisher's If.	—	—	41	20 N	307	40
Flambrough Head	—	—	54	8 N	18	10
Flores I. (Azores)	—	—	39	40 N	348	20
Floris I.	—	—	8	50 S	142	40
the Fly	—	—	53	18 N	23	45
Fontarabia	—	—	43	30 N	15	30
Formentaria I.	—	—	38	44 N	20	0
Formosa I.	—	—	23	46 N	138	9
Fort St. George	—	—	13	8 N	99	10
Fortaventuro I.	—	—	27	54 N	4	46
Foulfound	—	—	77	30 N	31	0
Freejuls	—	—	43	26 N	25	00
Fretum Borough	—	—	69	55 N	80	15
Fuogo I.	—	—	14	42 N	353	42
Furnefs	—	—	51	15 N	21	0
Fyal I.	—	—	38	53 N	350	54

H 6

G.

	G	Latitude.		Long.	
		D.	M.	D.	M.
Gallopega I.	—	0	0	288	0
Galloway	—	53	10 N	8	25
Gamart If.	—	65	48 N	350	40
Gambaroon I.	—	27	30 N	74	46
Gallitta I.	—	37	40 N	26	44
Gelder	—	52	0 N	23	30
Genberman's Rocks	—	66	23 N	357	20
Genoa	—	44	25 N	26	50
Gibraltar	—	36	11 N	12	27
Gigeria	—	37	6 N	24	20
Girona	—	41	45 N	22	0
Glasco	—	55	53 N	14	5
Goa	—	15	31 N	91	47
Gomera I.	—	28	0 N	0	44
Gorgona I.	—	43	34 N	27	48
Gothland I.	—	58	0 N	37	0
Gottenburgh	—	57	33 N	30	35
Granado I.	—	12	7 N	317	40
Grand I.	—	44	0 N	34	35
Gratiosa	—	39	25 N	351	0
Greenwich Obf.	—	51	29 N	18	0
Greys I.	—	50	35 N	324	45
Grim's I.	—	66	51 N	355	57
Grimfa I.	—	67	22 N	355	26
Guina I.	—	16	52 N	289	40
Guardalupa I.	—	16	15 N	316	10
Guatimala	—	14	25 N	276	10
Guernsey I.	—	49	31 N	15	30
Gulf of Bothnia	—	64	0 N	38	0
— Contessa	—	41	0 N	43	10
— Finland	—	59	50 N	43	0
— Gambaya	—	23	0 N	90	30
— Lyons	—	42	30 N	21	30
— Mexico	—	24	0 N	288	0
— Persian	—	27	0 N	68	0
— Salina	—	10	0 N	290	10
— Salonica	—	41	10 N	41	0
— Sidra	—	33	0 N	39	0

Gulph

LATITUDE and LONGITUDE.

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		Latitude.		Long.	
		D.	M.	D.	M.
Gulph Taranta	—	39	30 N	35	30
— Venice	—	44	0 N	33	0
H					
Hacluit's head Land	—	79	55 N	30	10
Halliford	—	64	30 N	343	27
Hambrough	—	53	41 N	28	24
Harbour I.	—	25	40 N	301	35
Harlem	—	52	25 N	22	30
Hartland point	—	51	6 N	13	35
Hartlepool	—	54	40 N	17	16
Harwich	—	52	11 N	19	28
Havana	—	22	50 N	294	40
Havre de Grace	—	50	0 N	18	30
Heel	—	54	40 N	37	18
Hermanos I.	—	3	2 S	82	10
Helies Sound	—	79	15 N	30	15
Helighland	—	54	28 N	26	45
Hispaniola I.	—	19	10 N	307	20
Hockfew	—	26	30 N	136	30
Hoingan	—	33	35 N	137	15
Holy Head	—	53	23 N	13	30
Holy I.	—	55	45 N	16	40
Hondy B.	—	22	35 N	293	30
Hope I.	—	76	22 N	40	10
Horn B.	—	64	42 N	6	0
Horn Sound	—	77	23 N	32	30
Hornsey I.	—	6	0 S	190	0
Hudson's B.	—	60	0 N	256	0
Hull	—	53	48 N	17	43
Hyneago I.	—	20	57 N	304	50
I					
Iago I.	—	15	20 N	354	32
Jamaica I.	—	18	00 N	301	6
James Town	—	37	10 N	303	0
Japan If.	—	36	0 N	149	0
Jaque Jaque	—	4	16 N	14	00
Java I.					

		Latitude.		Long.	
		D.	M.	D.	M.
Java I.	—	7	40 S	119	30
Icepoint	—	77	40 N	87	20
Iceland I.	—	66	0 N	350	0
Jerusalem	—	32	10 N	54	0
Jersey I.	—	49	16 N	16	0
Illathera I.	—	25	0 N	302	8
Joanna I.	—	12	15 S	62	43
Joppa	—	32	46 N	54	10
Juan Fernando I.	—	33	20 S	291	22
K					
Kalmer	—	56	40 N	34	50
Kastof	—	44	0 N	51	0
Kilduin	—	69	32 N	48	25
Kinsale	—	51	50 N	8	30
Koningsberg	—	54	45 N	38	40
Kureffihii	—	41	40 N	57	50
L					
La Serena	—	24	40 S	301	38
La Valona	—	40	56 N	39	34
La Vera Cruz	—	19	15 N	277	45
Ladrone Is.	—	18	0 N	162	0
Lambay	—	53	24 N	10	40
Lampo	—	30	10 N	38	35
Lancerotta I.	—	28	32 N	5	16
Landfort	—	58	40 N	36	30
Landfend	—	50	6 N	12	47
Langeness	—	66	56 N	5	10
Lariisa	—	39	30 N	22	0
Larwick	—	58	54 N	27	30
Lawenburgh	—	53	20 N	29	10
Lees Foreland	—	78	50 N	41	35
Leghorn	—	43	18 N	29	40
Leith	—	56	0 N	15	15
Lemnos I.	—	39	50 N	43	37
Lepanto	—	38	20 N	40	5
Leson I.	—	57	5 N	28	50
Lewis					

LATITUDE and LONGITUDE. 159

	Latitude.		Long.	
	D.	M.	D.	M.
Lewis I.	58	30 N	10	30
Lilboa I.	42	44 N	28	15
Lima	12	10 S	301	20
Limmeric	52	22 N	8	30
Limosa I.	36	00 N	30	30
Limpadofa I.	35	30 N	30	15
Lisbon	38	42 N	8	48
Lisbon Rock	38	54 N	8	40
Liverpool	53	20 N	15	12
Lizard	49	55 N	13	16
Loefort I	68	0 N	27	50
London	51	32 N	12	54
Londonderry	54	55 N	10	10
Long I.	40	50 N	302	30
Louisburgh	45	54 N	318	29
Lubeck	54	00 N	29	15
Luconio I.	15	30 N	138	6
Lunde	55	30 N	32	0
Lundy I.	51	20 N	13	30
M				
Maccas	22	13 N	131	45
Madagascar I.	20	0 S	64	20
Madeira If.	32	17 N	0	56
Maelstroom	67	30 N	30	0
Maesterland	57	58 N	29	55
Maerden	58	25 N	27	5
Magadoxo	2	1 N	60	30
Magellan Straits	51	58 S	302	40
Mailla	13	55 N	125	16
Majorca	39	0 N	19	40
Mallacca	2	10 N	119	50
Malaga	36	53 N	13	27
Maldivia If.	4	0 N	93	0
Malique I.	9	0 N	91	25
Malta I.	36	15 N	32	29
Man I.	54	0 N	13	29
Mansfield I.	62	20 N	297	00

Mar-

A TABLE OF

	Latitude.		Long.	
	D.	M.	D.	M.
Margaritta I.	11	20 N	314	50
Marigallante I.	15	53 N	317	50
Maritimo I.	38	12 N	30	5
Marseilles	43	20 N	23	20
Martinico I.	14	48 N	317	17
Marzanefs	66	8 N	354	10
Mafipore	16	30 N	100	7
Mauritius I.	20	5 S	73	15
May I.	15	16 N	355	30
Mayaguana I.	22	35 N	305	10
Mayetta I.	13	10 S	63	55
Melinde	3	0 S	58	10
Meraparovuz I.	21	57 N	303	30
Merchants Foreland	63	41 N	355	0
Messina	38	22 N	34	00
Middleberg	51	35 N	22	7
Milford	51	50 N	13	00
Mill Is.	64	20 N	298	2
Mindano I.	6	30 N	137	0
Minorca Is.	39	48 N	21	50
Mocha	14	00 N	63	30
Modon	36	52 N	39	20
Mohilla I.	12	15 S	61	51
Mollona	30	12 N	300	0
Mombafo	4	15 S	56	40
Monlock point	41	8 N	308	0
Monrose	56	40 N	16	25
Monserado	6	5 N	8	00
Monserat I.	16	40 N	315	35
Montpelier	43	36 N	21	40
Morlaix	48	37 N	14	20
Mofaimbique	15	5 S	58	40
Mucaros I.	21	30 N	301	35
Mull I.	57	20 N	11	50
N				
Nangafac	32	53 N	146	0
Nanquin	32	52 N	137	15

Man-

LATITUDE and LONGITUDE. 161

	Latitude.		Long.	
	D.	M.	D.	M.
Nantucket I.	40	58 N	309	42
Nantz	47	14 N	16	40
Naples	40	51 N	32	38
Narve	59	10 N	46	24
Nassau I.	2	44 S	116	42
Naze of Norway	57	50 N	25	32
Negropont I.	38	30 N	43	52
Nevis I.	17	6 N	315	52
Newcastle	54	58 N	16	40
Newfoundland I.	49	0 N	324	0
New York	40	40 N	304	0
Nicarague Entrance	11	15 N	293	5
Nice	43	45 N	25	15
Nicober I.	7	11 N	111	15
Nimpo	30	0 N	120	0
Niphon I.	36	0 N	155	0
Northbergen	60	16 N	23	50
North Cape (Lapland)	71	25 N	40	10
North Cape (America)	2	5 N	328	15
North Foreland	51	28 N	19	20
Nottenburgh	60	0 N	50	40
Nottingham I.	63	38 N	298	24

O

Oczakow	45	30 N	49	40
Oeland I.	57	0 N	35	0
Old Head	51	40 N	8	40
Oleron I.	46	0 N	17	36
Orbitello	42	15 N	30	10
Oran	35	46 N	19	15
Orfordness	52	20 N	19	20
Orkney Is.	59	13 N	14	40
Oronoque	8	15 N	319	5
Ostend	51	10 N	21	5
Otranto	40	52 N	37	10
Ovedo	43	30 N	11	0
Oysel I.	58	0 N	41	50

Pad-

P	Latitude.		Long.	
	D.	M.	D.	M.
Padrabancha Rocks	6	0 N	88	30
Padua	45	22 N	30	10
Palermo I.	38	20 N	32	28
Palma I.	28	50 N	0	10
Palmarolla I.	40	50 N	31	10
Panama	8	56 N	295	52
Pantalaria I.	36	53 N	31	19
Panuco	23	30 N	282	0
Papey I.	64	50 N	6	0
Parambuke	7	48 S	343	15
Paris	48	50 N	20	20
Parnaw	58	25 N	43	57
Patmos I.	37	30 N	45	10
Pekin	39	52 N	134	15
Pelting Sound	60	32 N	47	0
Penmark	47	48 N	13	55
Petersburg	59	58 N	48	20
Philippine Is.	12	0 N	140	0
Pico I. (Azores)	38	35 N	350	5
Pike of Teneriff	28	20 N	1	20
Piply	21	15 N	104	40
Pisa	43	8 N	29	50
Piscadore Is.	23	30 N	135	45
Placentia	47	57 N	323	10
Planosa I.	42	32 N	28	49
Platewrack	20	3 N	310	0
Plymouth	50	36 N	13	57
Point look out	76	40 N	34	35
Policaastro	40	18 N	34	30
Poma I.	43	14 N	34	10
Pondy	18	45 N	102	20
Pondycherry	11	54 N	98	10
Port del Gada	10	17 S	58	20
Port Mahon	39	42 N	22	32
Port Nelson	57	5 N	285	20
Port Royal	17	40 N	301	17
Port Steven	46	50 S	295	34
Porta Nova	11	45 N	97	54

Por-

LATITUDE and LONGITUDE. 163

	Latitude.		Long.	
	D.	M.	D.	M.
Porta Port	41	18 N	8	50
Porto	41	10 N	10	20
Porto Bello	9	33 N	297	50
Porto Rico	18	33 N	311	50
Porto Sancto I.	32	50 N	2	20
Portland	50	30 N	15	22
Portland	64	2 N	357	5
Portsmouth	50	48 N	17	10
Princes I.	6	30 S	122	12
Princeps I.	1	40 N	28	00
Providence I.	25	0 N	306	25
Pullacat	13	30 N	98	32
Q				
Quabella I.	3	49 S	70	50
Quebeck	47	5 N	308	00
Queen Anne's Foreland	63	32 N	303	19
Quemoy	24	35 N	135	5
Quiconga	10	0 S	32	0
Quilo	8	50 N	94	0
Quiola	9	40 S	56	0
Quipla	37	0 N	28	0
R				
Ragufa	43	00 N	36	0
Ramsdel	63	25 N	24	40
Raseberg	60	28 N	40	45
Ravenna	44	25 N	31	30
Ree I.	46	13 N	16	40
Resolution I.	61	55 N	313	20
Revel	59	20 N	42	55
Rhodes I.	36	40 N	46	10
Riga	57	10 N	43	0
River Albany	52	32 N	295	5
— Amazons	0	0	329	10
— Camerones	3	30 N	28	00
— Congo	5	45 S	33	35

River

A TABLE OF

		Latitude.		Long.	
		D.	M.	D.	M.
River Croce	—	35	0 N	138	0
— Danube	—	46	0 N	50	0
— de Angra	—	0	49 N	29	0
— Churchill	—	59	0 N	283	10
— de Fuegos	—	0	0	59	00
— Don	—	51	0 N	65	0
— Dwina	—	65	0 N	62	0
— Ebro	—	40	20 N	19	0
— Elbe	—	54	0 N	28	0
— Formosa	—	7	0 N	25	50
— Gambia	—	14	0 N	1	30
— Ganges	—	23	0 N	104	0
— Garonne	—	44	0 N	11	30
— Grande (America)	—	31	55 S	326	00
— Grande (Africa)	—	11	40 N	3	30
— Guadiane	—	36	30 N	10	0
— Humber	—	53	30 N	18	12
— Juneiro	—	22	53 S	335	30
— Indus	—	25	0 N	86	0
— Infanto	—	30	0 S	46	0
— Julian	—	48	40 S	303	38
— Kiang	—	32	0 N	138	20
— Lamas	—	1	20 S	58	23
— Loyre	—	47	0 N	15	30
— Nile	—	31	0 N	50	0
— Niper	—	47	30 N	51	0
— Oby	—	70	0 N	80	0
— Oder	—	54	0 N	28	0
— Oronoque	—	8	40 N	318	0
— Plate	—	35	0 S	320	0
— Po	—	45	0 N	31	0
— Rhine	—	52	0 N	23	0
— Rofne	—	42	40 N	22	20
— Rupert	—	51	16 S	299	15
— St. Andrew	—	5	0 N	13	55
— St. Francisco	—	10	55 S	340	24
— St. Lawrence	—	49	0 N	318	30
— St. Lucia	—	30	25 S	48	25
				River	

LATITUDE and LONGITUDE.

165

	Latitude.		Long.	
	D.	M.	D.	M.
River St. Mary	22	0 S	53	0
— Samfon	4	0 N	31	18
— Sana	12	0 N	3	0
— Senegal	16	0 N	1	0
— Sefter	5	20 N	9	00
— Severn	51	34 N	15	25
— Seyne	49	30 N	17	50
— Tajo	38	0 N	9	0
— Tees	54	25 N	16	52
— Thames	51	30 N	19	0
— Tiber	41	30 N	30	30
— Tine	60	0 N	16	50
— Viftule	54	0 N	38	0
— Volga	45	20 N	75	0
— Volto	5	40 N	21	40
— Zambre	17	0 S	53	0
— Zara	4	20 S	31	0
Rochel	46	10 N	16	56
Rodonto	17	5 N	316	55
Rome	41	51 N	30	48
Romeras de Castellanes I.	29	5 S	92	36
Rook Point	64	0 N	352	7
Rofanna	39	40 N	36	0
Rofes	42	10 N	22	0
Rottoc	54	20 N	30	30
Rotterdam	51	55 N	22	30
Roven	49	30 N	19	20
Rum Key I.	23	45 N	303	5
Runnen I.	57	55 N	42	10
S				
Sable I.	44	30 N	319	5
Sacatra I.	12	28 N	73	47
Saint Antonio I.	17	10 N	352	2
— Auguftine	30	0 N	296	20
— Bartholomew I.	17	54 N	215	25
— Brandon I.	16	38 S	82	40
— Catharines I.	28	0 S	330	20

Saint

A TABLE OF

	Latitude.		Long.	
	D.	M.	D	M.
Saint Christophers I. —	17	22 N	315	0
— Cruz I. —	17	38 N	314	34
— David's Head —	51	55 N	12	48
— Domingo —	18	15 N	307	20
— George I. —	38	56 N	352	0
— Helena I. —	16	00 S	12	30
— John de Lisbon —	26	4 S	71	48
— John's Harbour —	48	00 N	324	45
— Juan de Novo'I. —	17	30 S	60	45
— Kilday —	58	2 N	8	5
— Laurence I. —	12	30 S	68	20
— Lucia I. (C. verd If.) —	16	45 N	352	40
— Lucia I. (Caribbee If.) —	13	52 N	318	53
— Malo —	48	40 N	16	20
— Martin's I. —	18	5 N	315	30
— Mary's I. (Scylly) —	49	58 N	11	50
— Mary's I. (Azores) —	37	0 N	355	0
— Mathew's I. —	1	40 S	10	15
— Michael I. —	38	0 N	355	38
— Nicholas —	16	40 N	353	20
— Paul I. —	1	20 S	326	26
— Pedro I. —	12	0 N	200	0
— Salvador —	13	0 S	283	0
— Sebastian —	43	32 N	16	43
— Thomas I. —	0	0	26	0
— Valery —	50	10 N	19	6
— Vincent I. —	13	12 N	318	48
— Vincent I. —	16	55 N	353	32
— Sal I. —	16	45 N	355	40
Salamanca —	17	0 N	286	0
Sallee —	33	43 N	11	40
Salonica —	40	41 N	41	40
Salisbury I. —	63	48 N	300	40
Sambrero I. —	18	40 N	315	40
Sardinia I. —	39	30 N	26	44
Scanderon —	36	0 N	54	8
Scarbrough —	54	20 N	17	30
Scaw —	57	26 N	28	20

Schelin

LATITUDE and LONGITUDE. 167

		Latitude.		Long.	
		D.	M.	D.	M.
Schelin	_____	53	25 N	24	8
Scilly I.	_____	49	50 N	10	54
Scio I.	_____	38	20 N	44	45
Scots Settlement	_____	8	30 N	299	25
Segura Port	_____	16	22 S	337	12
Selam I.	_____	8	20 S	120	23
Sematto I.	_____	35	46 N	32	25
Senegal	_____	15	16 N	2	0
Senta	_____	35	55 N	12	23
Serralion	_____	8	36 N	5	55
Sevil	_____	37	37 N	11	44
Shark Point	_____	64	27 N	294	50
Sheals	_____	55	2 N	16	50
Sherbro Fort	_____	6	0 N	5	0
Shetland If.	_____	60	43 N	15	40
Siam B.	_____	13	30 N	119	5
Siatto I.	_____	39	10 N	43	55
Sicily I.	_____	37	0 N	32	0
Sinfunday B.	_____	42	45 S	319	10
Sky I.	_____	57	48 N	12	10
Sline head	_____	53	20 N	6	55
Sluyce	_____	51	19 N	22	0
Smyrna	_____	38	30 N	45	20
Snowhill	_____	65	11 N	350	56
Sound Royal	_____	66	22 N	353	27
South Cape	_____	44	0 S	161	0
South Foreland	_____	51	12 N	19	30
Spirito Sancto	_____	19	58 S	336	10
Spitsberg	_____	78	0 N	48	0
Spurn	_____	53	35 N	18	40
Stadland	_____	62	10 N	22	48
Stalimene I.	_____	41	10 N	44	40
Start Point	_____	50	9 N	14	5
Staten I.	_____	62	0 N	335	30
Stockholm	_____	59	20 N	37	0
Stockton	_____	54	33 N	16	45
Strael Sound	_____	54	35 N	31	30
Straits of Annian	_____	50	0 N	250	0

Straits

A TABLE OF

		Latitude.		Long.	
		D.	M.	D. M.	
Straits of Babelmandel	—	12	0 N	63 30	
— Coffa	—	44	30 N	55 0	
— Constantinople	—	41	0 N	47 30	
— Corfica	—	42	0 N	27 20	
— Dampiers	—	6	0 S	165 0	
— Davis	—	70	0 N	292 0	
— Dover	—	51	0 N	19 20	
— Gibraltar	—	36	0 N	12 0	
— Hellespont	—	40	0 N	45 0	
— Hudson's	—	62	0 N	275 0	
— Magellan	—	53	40 N	293 0	
— Messina	—	38	0 N	34 0	
— Ormus	—	28	0 N	75 0	
— of the Sound	—	56	0 N	30 40	
— Sunda	—	5	52 S	124 0	
— Uriez	—	46	0 N	165 0	
— Weigate	—	71	0 N	83 0	
Strombello I.	—	39	0 N	34 40	
Sumatra I.	—	5	35 S	119 0	
Sunda If.	—	5	0 S	123 0	
Sunderland	—	54	52 N	16 50	
Suranam	—	6	0 N	321 15	
Surat	—	21	8 N	90 00	
Surroy	—	71	5 N	34 50	
Susa	—	35	50 N	28 12	
Sweetnose	—	68	8 N	52 52	
Syracuse	—	37	05 N	33 00	
T					
Tabasco	—	19	0 N	286 0	
Tadafock	—	49	0 N	310 00	
Tangier	—	35	55 N	11 56	
Taranto	—	40	40 N	36 10	
Tarragon	—	40	55 N	19 40	
Taffo I.	—	40	10 N	44 55	
Tenerif. I.	—	28	20 N	1 25	
Tercera I.	—	38	53 N	353 28	
Terra del Fuogo I.	—	54	0 S	313 0	
					Terra

LATITUDE and LONGITUDE. 169

	Latitude.		Long.	
	D.	M.	D.	M.
Terra del Gada	19	29 S	62	45
Testigos I.	11	40 N	315	29
Tetuan	35	28 N	12	18
Texel	53	10 N	23	9
Tobago I.	11	10 N	318	50
Todus Sanctus B.	13	0 S	337	35
Tongon	5	10 S	57	17
Topham	50	37 N	13	25
Torneo	65	51 N	42	05
Tortosa	40	54 N	19	24
Toulon	43	6 N	23	50
Trinidad	20	30 S	348	10
Trinidad I.	10	5 N	318	5
Trinity B.	48	50 N	325	15
Tripoli	32	24 N	31	20
Tristian de Cunha J.	37	5 S	12	32
Tromsund	70	18 N	34	10
Truxillo	9	40 S	305	0
Tunis	36	50 N	28	10
Tunquin	20	50 N	123	15
Turks I.	21	35 N	308	0
V				
Vagaron	17	0 N	115	0
Valencia	39	25 N	18	40
Valterborn	55	20 N	31	5
Varna	45	0 N	47	0
Venice	45	25 N	30	10
Vera Cruz	19	12 N	280	24
Verkin's I.	2	22 N	109	17
Villa rica	20	0 N	283	0
Viner's I.	53	5 N	294	57
Virgin's I.	18	23 N	314	10
Virgin's Rocks	46	6 N	327	5
Vifegapatam	17	40 N	101	17
Uraniburgh	55	54 N	31	0
Ushant I.	48	30 N	13	5
Ulica	38	54 N	32	14
				W.

A TABLE OF, &c.

	W.	Latitude.		Long.	
		D.	M.	D.	M.
Wardus	—	71	10 N	47	30
Waterford	—	52	7 N	10	20
Watling I.	—	24	7 N	303	20
Westmania I.	—	63	51 N	354	32
Wexford	—	52	13 N	10	54
Whales Back	—	65	27 N	357	37
Whales Head	—	77	18 N	39	49
Whitby	—	54	30 N	17	20
Whitehaven	—	54	25 N	14	55
Wight I.	—	51	0 N	16	30
Wilsby	—	57	37 N	37	0
Wismar	—	54	10 N	30	10
Wyborg	—	60	52 N	47	36
X.					
Xango	—	12	0 S	58	0
Y.					
Yarmouth	—	52	45 N	19	50
Yas de Amber I.	—	0	0	70	40
Yas de Digo roys I.	—	0	0	90	15
Yla I.	—	56	10 N	11	14
Yvica	—	39	5 N	21	0
Z.					
Zant I.	—	37	47 N	39	20
Zara	—	44	25 N	34	10
Zeila	—	10	10 N	64	0
Zuchris	—	33	0 N	20	0
Zunaquitta I.	—	17	1 N	288	33
Zuphen,	—	52	4 N	25	0

A TRAVERSE

A TRAVERSE TABLE. 171

A Traverse TABLE, or Table of Difference of Latitude and Departure in Miles; to every quarter Point of the Compass, and every Degree of the Quadrant.

To find the diff. Latitude and Departure for any Course and Distance.

R U L E.

Look for the course at the head or foot of the table where you can find it, and then for the distance on the left hand side; against which distance, in the column of the course, you have the diff. lat. and departure, in their proper columns; under the words *Lat. Dep.* if the course is on the top; and above the words *Lat. Dep.* if at bottom of the table. If the distance be greater than the table contains (which seldom happens) it must be taken out at twice or thrice.

Examp. 1. Let the distance sail'd be 24 miles, and the course $3\frac{1}{2}$ points from the meridian. Under $3\frac{1}{2}$ points, and over against 24 on the side, you have 18.6 for the diff. lat. and 15.3 for the departure.

Examp. 2. Let the distance run be 85 miles, and the course 67 deg. from the meridian. Because the distance exceeds the table, it must be taken out at twice, for the two distances 60 and 25 which make 85. Thus, above 67 the course at bottom, and against 60 on the side, you have the diff. lat. 23.4, and departure 55.2: *Again,* Above 67, and against 25, you have the diff. lat. 9.8, and departure 23.0, therefore the whole diff. lat. is 33.2; and the whole departure 78.2.

I 2

Diff.

172 A TRAVERSE TABLE.

Dist.	$\frac{1}{4}$ Point.		$\frac{1}{2}$ Point.		$\frac{3}{4}$ Point.		1 Point.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
1	1.0	0.0	1.0	0.1	1.0	0.1	1.0	0.2
2	2.0	0.1	2.0	0.2	2.0	0.3	2.0	0.4
3	3.0	0.1	3.0	0.3	3.0	0.4	2.9	0.6
4	4.0	0.2	4.0	0.4	4.0	0.6	3.9	0.8
5	5.0	0.2	5.0	0.5	5.0	0.7	4.9	1.0
6	6.0	0.3	6.0	0.6	5.9	0.8	5.9	1.2
7	7.0	0.3	7.0	0.7	6.9	1.0	6.9	1.4
8	8.0	0.4	8.0	0.8	7.9	1.2	7.8	1.6
9	9.0	0.4	9.0	0.9	8.9	1.3	8.8	1.8
10	10.0	0.5	10.0	1.0	9.9	1.5	9.8	2.0
11	11.0	0.5	10.9	1.1	10.9	1.6	10.8	2.1
12	12.0	0.6	11.9	1.2	11.9	1.8	11.8	2.3
13	13.0	0.6	12.9	1.3	12.9	1.9	12.8	2.5
14	14.0	0.7	13.9	1.4	13.9	2.0	13.7	2.7
15	15.0	0.7	14.9	1.5	14.9	2.2	14.7	2.9
16	16.0	0.8	15.9	1.6	15.9	2.3	15.7	3.1
17	17.0	0.8	16.9	1.7	16.9	2.5	16.7	3.3
18	18.0	0.9	17.9	1.8	17.8	2.6	17.7	3.5
19	19.0	0.9	18.9	1.9	18.8	2.8	18.6	3.7
20	20.0	1.0	19.9	2.0	19.8	2.9	19.6	3.9
21	21.0	1.0	20.9	2.1	20.8	3.1	20.6	4.1
22	22.0	1.1	21.9	2.2	21.8	3.2	21.6	4.3
23	23.0	1.1	22.9	2.3	22.8	3.4	22.6	4.5
24	24.0	1.2	23.9	2.4	23.8	3.5	23.6	4.7
25	25.0	1.2	24.9	2.5	24.8	3.7	24.5	4.9
26	26.0	1.3	25.9	2.6	25.7	3.8	25.5	5.1
27	27.0	1.3	26.9	2.7	26.7	4.0	26.5	5.3
28	28.0	1.4	27.9	2.8	27.7	4.1	27.5	5.5
29	29.0	1.4	28.9	2.9	28.7	4.3	28.4	5.7
30	30.0	1.5	29.9	2.9	29.7	4.4	29.4	5.8
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.
	$7\frac{1}{4}$ Point.		$7\frac{1}{2}$ Point.		$7\frac{3}{4}$ Point.		7 Point.	

A TRAVERSE TABLE.

173

Diff.	$\frac{1}{4}$ Point.		$\frac{1}{2}$ Point.		$\frac{3}{4}$ Point.		1 Point.	
	Lat. Dep.		Lat. Dep.		Lat. Dep.		Lat. Dep.	
31	31.0	1.5	30.8	3.0	30.7	4.6	30.4	6.0
32	32.0	1.6	31.8	3.1	31.7	4.7	31.4	6.2
33	33.0	1.6	32.8	3.2	32.7	4.9	32.4	6.4
34	34.0	1.7	33.8	3.3	33.7	5.0	33.3	6.6
35	35.0	1.7	34.8	3.4	34.6	5.2	34.3	6.8
36	36.0	1.8	35.8	3.5	35.6	5.3	35.3	7.0
37	37.0	1.8	36.8	3.6	36.6	5.5	36.3	7.2
38	38.0	1.9	37.8	3.7	37.6	5.6	37.3	7.4
39	39.0	1.9	38.8	3.8	38.6	5.8	38.3	7.6
40	40.0	2.0	39.8	3.9	39.6	5.9	39.2	7.8
41	40.9	2.0	40.8	4.0	40.6	6.1	40.2	8.0
42	41.9	2.1	41.8	4.1	41.6	6.2	41.2	8.2
43	42.9	2.1	42.8	4.2	42.5	6.4	42.2	8.4
44	43.9	2.2	43.8	4.3	43.5	6.5	43.2	8.6
45	44.9	2.2	44.8	4.4	44.5	6.7	44.1	8.8
46	45.9	2.3	45.8	4.5	45.5	6.8	45.1	9.0
47	46.9	2.3	46.8	4.6	46.5	7.0	46.1	9.2
48	47.9	2.4	47.8	4.7	47.5	7.1	47.1	9.4
49	48.9	2.4	48.8	4.8	48.5	7.2	48.1	9.6
50	49.9	2.5	49.8	4.9	49.5	7.3	49.0	9.8
51	50.9	2.5	50.7	5.0	50.4	7.5	50.0	9.9
52	51.9	2.5	51.7	5.1	51.4	7.6	51.0	10.1
53	52.9	2.6	52.7	5.2	52.4	7.8	52.0	10.3
54	53.9	2.6	53.7	5.3	53.4	7.9	53.0	10.5
55	54.9	2.7	54.7	5.4	54.4	8.1	53.9	10.7
56	55.9	2.7	55.7	5.5	55.4	8.2	54.9	10.9
57	56.9	2.8	56.7	5.6	56.4	8.4	55.9	11.1
58	57.9	2.8	57.7	5.7	57.4	8.5	56.9	11.3
59	58.9	2.9	58.7	5.8	58.3	8.6	57.9	11.5
60	59.9	2.9	59.7	5.9	59.3	8.8	58.8	11.7
	Dep. Lat.		Dep. Lat.		Dep. Lat.		Dep. Lat.	
	$7\frac{3}{4}$ Points.		$7\frac{1}{2}$ Point.		$7\frac{1}{4}$ Point.		7 Points.	

A TRAVERSE TABLE.

Diff.	1 $\frac{1}{4}$ Point.		1 $\frac{1}{2}$ Point.		1 $\frac{3}{4}$ Point.		2 Points.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
1	1.0	0.2	1.0	0.3	0.9	0.3	0.9	0.4
2	1.9	0.5	1.9	0.6	1.9	0.7	1.8	0.8
3	2.9	0.7	2.9	0.9	2.8	1.0	2.8	1.1
4	3.9	1.0	3.8	1.2	3.8	1.3	3.7	1.5
5	4.8	1.2	4.8	1.5	4.7	1.7	4.6	1.9
6	5.8	1.4	5.7	1.7	5.6	2.0	5.5	2.3
7	6.8	1.7	6.7	2.0	6.6	2.4	6.5	2.7
8	7.8	1.9	7.6	2.3	7.6	2.7	7.4	3.1
9	8.7	2.2	8.6	2.6	8.5	3.0	8.3	3.4
10	9.7	2.4	9.6	2.9	9.4	3.4	9.2	3.8
11	10.7	2.7	10.5	3.2	10.3	3.7	10.2	4.2
12	11.6	2.9	11.5	3.5	11.3	4.0	11.1	4.6
13	12.6	3.1	12.4	3.8	12.2	4.4	12.0	5.0
14	13.6	3.4	13.4	4.1	13.2	4.8	13.0	5.4
15	14.6	3.6	14.3	4.4	14.1	5.1	13.9	5.8
16	15.5	3.9	15.3	4.7	15.0	5.4	14.8	6.1
17	16.5	4.1	16.2	5.0	16.0	5.7	15.7	6.5
18	17.5	4.4	17.2	5.2	16.9	6.0	16.7	6.9
19	18.4	4.6	18.2	5.5	17.9	6.4	17.6	7.2
20	19.4	4.8	19.1	5.8	18.8	6.7	18.5	7.6
21	20.4	5.0	20.1	6.1	19.7	7.0	19.5	8.0
22	21.3	5.3	21.0	6.4	20.7	7.4	20.4	8.4
23	22.3	5.6	22.0	6.7	21.6	7.7	21.3	8.8
24	23.3	5.8	23.0	7.0	22.6	8.0	22.2	9.1
25	24.2	6.0	23.9	7.3	23.5	8.4	23.1	9.5
26	25.2	6.3	24.9	7.6	24.4	8.7	24.0	9.9
27	26.2	6.5	25.8	7.9	25.4	9.0	25.0	10.3
28	27.2	6.8	26.8	8.2	26.3	9.4	25.9	10.7
29	28.1	7.0	27.7	8.5	27.2	9.7	26.8	11.1
30	29.1	7.3	28.7	8.7	28.2	10.1	27.7	11.5
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.
	6 $\frac{3}{4}$ Point.		6 $\frac{1}{2}$ Point.		6 $\frac{1}{4}$ Point.		6 Points.	

A TRAVERSE TABLE.

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Dif.	1 $\frac{1}{4}$ Point.		1 $\frac{1}{2}$ Point.		1 $\frac{3}{4}$ Point.		2 Points.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
31	30.1	7.5	29.6	9.0	29.1	10.4	28.6	11.9
32	31.0	7.7	30.6	9.2	30.1	10.8	29.5	12.3
33	32.0	8.0	31.6	9.5	31.0	11.1	30.5	12.7
34	33.0	8.2	32.5	9.8	31.9	11.4	31.4	13.1
35	34.0	8.5	33.5	10.1	32.9	11.8	32.3	13.5
36	34.9	8.7	34.4	10.4	33.8	12.1	33.2	13.8
37	35.9	9.0	35.4	10.7	34.8	12.4	34.1	14.2
38	36.9	9.2	36.3	11.0	35.7	12.8	35.0	14.6
39	37.8	9.4	37.3	11.3	36.7	13.1	36.0	15.0
40	38.8	9.7	38.3	11.6	37.7	13.5	36.9	15.3
41	39.8	9.9	39.2	11.9	38.6	13.8	37.8	15.7
42	40.7	10.2	40.2	12.2	39.6	14.1	38.7	16.1
43	41.7	10.4	41.1	12.5	40.5	14.5	39.6	16.5
44	42.7	10.7	42.1	12.8	41.4	14.8	40.6	16.9
45	43.7	10.9	43.0	13.0	42.4	15.1	41.5	17.2
46	44.6	11.1	44.0	13.3	43.3	15.5	42.4	17.6
47	45.6	11.4	44.9	13.6	44.3	15.8	43.4	18.0
48	46.6	11.6	45.9	13.9	45.2	16.1	44.3	18.4
49	47.5	11.9	46.9	14.2	46.2	16.5	45.2	18.8
50	48.5	12.1	47.8	14.5	47.1	16.8	46.2	19.1
51	49.5	12.3	48.8	14.8	48.0	17.1	47.1	19.5
52	50.4	12.6	49.7	15.1	49.0	17.5	48.0	19.9
53	51.4	12.8	50.7	15.4	49.9	17.9	49.0	20.2
54	52.4	13.1	51.6	15.7	50.8	18.2	49.9	20.6
55	53.4	13.3	52.6	16.0	51.8	18.5	50.8	21.0
56	54.3	13.6	53.5	16.3	52.7	18.9	51.8	21.4
57	55.3	13.8	54.5	16.6	53.7	19.2	52.7	21.8
58	56.3	14.0	55.4	16.9	54.6	19.5	53.6	22.2
59	57.2	14.3	56.4	17.1	55.6	19.9	54.5	22.6
60	58.2	14.5	57.4	17.4	56.5	20.2	55.4	23.0
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.
	6 $\frac{3}{4}$ Point.		6 $\frac{1}{2}$ Point.		6 $\frac{1}{4}$ Point.		6 Points.	

A TRAVERSE TABLE.

Diff.	$2\frac{1}{4}$ Point.		$2\frac{1}{2}$ Point.		$2\frac{3}{4}$ Point.		3 Points.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
1	0.9	0.4	0.9	0.5	0.9	0.5	0.8	0.6
2	1.8	0.9	1.8	0.9	1.7	1.0	1.7	1.1
3	2.7	1.3	2.6	1.4	2.6	1.5	2.5	1.7
4	3.6	1.7	3.5	1.9	3.4	2.1	3.3	2.2
5	4.5	2.1	4.4	2.4	4.3	2.6	4.2	2.8
6	5.4	2.6	5.3	2.8	5.1	3.1	5.0	3.3
7	6.3	3.0	6.2	3.3	6.0	3.6	5.8	3.9
8	7.2	3.4	7.0	3.8	6.9	4.1	6.7	4.4
9	8.1	3.8	7.9	4.2	7.7	4.6	7.5	5.0
10	9.0	4.3	8.8	4.7	8.6	5.1	8.3	5.6
11	9.9	4.7	9.7	5.2	9.4	5.6	9.2	6.1
12	10.8	5.1	10.6	5.6	10.3	6.2	10.0	6.7
13	11.7	5.6	11.5	6.1	11.1	6.7	10.8	7.2
14	12.6	6.0	12.4	6.5	12.0	7.2	11.7	7.8
15	13.5	6.4	13.2	7.0	12.9	7.7	12.5	8.3
16	14.5	6.9	14.1	7.5	13.7	8.2	13.3	8.9
17	15.4	7.3	15.0	7.9	14.6	8.7	14.2	9.4
18	16.3	7.7	15.9	8.4	15.4	9.2	15.0	10.0
19	17.2	8.1	16.8	8.9	16.3	9.7	15.8	10.6
20	18.1	8.6	17.6	9.4	17.1	10.3	16.6	11.1
21	19.0	9.0	18.5	9.8	18.0	10.8	17.5	11.7
22	19.9	9.4	19.4	10.3	18.9	11.3	18.3	12.2
23	20.8	9.8	20.3	10.8	19.7	11.8	19.2	12.8
24	21.7	10.3	21.2	11.2	20.6	12.3	20.0	13.3
25	22.6	10.7	22.1	11.7	21.4	12.8	20.8	13.9
26	23.5	11.1	23.0	12.2	22.3	13.3	21.7	14.4
27	24.4	11.6	23.8	12.6	23.1	13.8	22.5	15.0
28	25.3	12.0	24.7	13.1	24.0	14.3	23.3	15.6
29	26.2	12.4	25.6	13.6	24.9	14.8	24.1	16.1
30	27.1	12.8	26.5	14.1	25.7	15.4	24.9	16.7
	Dep. Lat.		Dep. Lat.		Dep. Lat.		Dep. Lat.	
	$5\frac{3}{4}$ Point.		$5\frac{1}{2}$ Point.		$5\frac{1}{4}$ Point.		5 Points.	

A TRAVERSE TABLE.

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Diff.	2 $\frac{1}{4}$ Point.		2 $\frac{1}{2}$ Point.		2 $\frac{3}{4}$ Point.		3 Points.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
31	28.0	13.3	27.4	14.5	26.6	15.9	25.7	17.2
32	28.9	13.7	28.2	15.0	27.4	16.4	26.5	17.8
33	29.8	14.1	29.1	15.5	28.3	16.9	27.3	18.3
34	30.7	14.6	30.0	15.9	29.1	17.4	28.2	18.9
35	31.6	15.0	30.9	16.4	30.0	17.9	29.1	19.4
36	32.5	15.4	31.8	16.9	30.9	18.5	29.9	20.0
37	33.4	15.8	32.6	17.4	31.7	19.0	30.8	20.6
38	34.3	16.3	33.5	17.9	32.6	19.5	31.6	21.1
39	35.2	16.7	34.4	18.4	33.4	20.1	32.4	21.7
40	36.1	17.1	35.3	18.9	34.3	20.6	33.3	22.2
41	37.0	17.6	36.2	19.3	35.1	21.1	34.1	22.8
42	37.9	18.0	37.1	19.8	36.0	21.6	34.9	23.3
43	38.8	18.4	38.0	20.3	36.9	22.1	35.8	23.9
44	39.7	18.9	38.8	20.8	37.7	22.6	36.6	24.4
45	40.6	19.3	39.7	21.2	38.6	23.1	37.4	25.0
46	41.6	19.7	40.6	21.7	39.4	23.6	38.3	25.6
47	42.5	20.1	41.5	22.2	40.3	24.2	39.1	26.1
48	43.4	20.6	42.4	22.7	41.1	24.7	39.9	26.7
49	44.3	21.0	43.2	23.2	42.0	25.2	40.8	27.2
50	45.2	21.4	44.1	23.6	42.9	25.7	41.6	27.8
51	46.1	21.8	45.0	24.1	43.7	26.2	42.4	28.3
52	47.0	22.3	45.9	24.5	44.6	26.7	43.3	28.9
53	47.9	22.7	46.8	24.9	45.4	27.2	44.1	29.4
54	48.8	23.1	47.7	25.4	46.3	27.7	44.9	30.0
55	49.7	23.6	48.5	25.9	47.1	28.3	45.7	30.6
56	50.6	24.0	49.4	26.4	48.0	28.8	46.6	31.1
57	51.5	24.4	50.3	26.8	48.9	29.3	47.4	31.7
58	52.4	24.8	51.2	27.3	49.7	29.8	48.3	32.2
59	53.3	25.2	52.0	27.8	50.6	30.3	49.1	32.8
60	54.2	25.6	52.9	28.3	51.5	30.8	49.9	33.3
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.
	5 $\frac{3}{4}$ Point		5 $\frac{1}{2}$ Point		5 $\frac{1}{4}$ Point		5 Points.	

A TRAVERSE TABLE.

Diff.	3 $\frac{1}{4}$ Point.		3 $\frac{1}{2}$ Point.		3 $\frac{3}{4}$ Point.		4 Points.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
1	0.8	0.6	0.8	0.6	0.7	0.7	0.7	0.7
2	1.6	1.2	1.6	1.3	1.5	1.3	1.4	1.4
3	2.4	1.8	2.3	1.9	2.2	2.0	2.1	2.1
4	3.2	2.4	3.1	2.5	3.0	2.7	2.8	2.8
5	4.0	3.0	3.9	3.2	3.7	3.4	3.5	3.5
6	4.8	3.6	4.6	3.8	4.4	4.0	4.2	4.2
7	5.6	4.2	5.4	4.4	5.2	4.7	4.9	4.9
8	6.4	4.8	6.2	5.1	5.9	5.4	5.7	5.7
9	7.2	5.4	7.0	5.7	6.7	6.0	6.4	6.4
10	8.0	6.0	7.7	6.3	7.4	6.7	7.1	7.1
11	8.8	6.6	8.5	6.9	8.1	7.4	7.8	7.8
12	9.6	7.2	9.2	7.5	8.9	8.0	8.5	8.5
13	10.4	7.8	10.0	8.2	9.6	8.7	9.2	9.2
14	11.2	8.4	10.8	8.8	10.4	9.4	9.9	9.9
15	12.0	9.0	11.6	9.4	11.1	10.0	10.6	10.6
16	12.8	9.6	12.4	10.1	11.9	10.7	11.3	11.3
17	13.6	10.2	13.2	10.7	12.6	11.4	12.0	12.0
18	14.4	10.8	14.0	11.3	13.4	12.0	12.7	12.7
19	15.2	11.4	14.7	12.0	14.1	12.7	13.4	13.4
20	16.1	11.9	15.5	12.7	14.8	13.4	14.1	14.1
21	16.9	12.5	16.3	13.3	15.6	14.1	14.8	14.8
22	17.7	13.1	17.1	13.9	16.3	14.8	15.6	15.6
23	18.5	13.7	17.9	14.6	17.1	15.5	16.3	16.3
24	19.3	14.3	18.6	15.3	17.8	16.1	17.0	17.0
25	20.1	14.9	19.4	15.9	18.6	16.8	17.7	17.7
26	20.9	15.5	20.2	16.6	19.3	17.5	18.4	18.4
27	21.7	16.1	21.0	17.2	20.1	18.1	19.1	19.1
28	22.5	16.7	21.7	17.8	20.7	18.8	19.8	19.8
29	23.3	17.3	22.5	18.4	21.5	19.5	20.5	20.5
30	24.1	17.9	23.2	19.0	22.2	20.1	21.2	21.2
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.
	4 $\frac{3}{4}$ Point.		4 $\frac{1}{2}$ Point.		4 $\frac{1}{4}$ Point.		4 Points.	

A TRAVERSE TABLE.

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Dif.	3 $\frac{1}{4}$ Point.		3 $\frac{1}{2}$ Point.		3 $\frac{3}{4}$ Point.		4 Points.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
31	24.9	18.5	24.0	19.6	23.0	20.8	21.9	21.9
32	25.7	19.1	24.7	20.3	23.7	21.5	22.6	22.6
33	26.5	19.7	25.5	20.9	24.4	22.1	23.3	23.3
34	27.3	20.3	26.2	21.5	25.2	22.8	24.0	24.0
35	28.1	20.9	27.0	22.2	25.9	23.5	24.7	24.7
36	28.9	21.5	27.8	22.8	26.7	24.1	25.4	25.4
37	29.7	22.1	28.6	23.4	27.4	24.8	26.2	26.2
38	30.5	22.7	29.3	24.1	28.1	25.5	26.9	26.9
39	31.3	23.3	30.1	24.7	28.9	26.2	27.6	27.6
40	32.1	23.8	30.9	25.4	29.6	26.9	28.3	28.3
41	32.9	24.4	31.6	26.0	30.4	27.5	29.0	29.0
42	33.7	25.0	32.4	26.6	31.1	28.2	29.7	29.7
43	34.5	25.6	33.2	27.2	31.9	28.9	30.4	30.4
44	35.3	26.2	34.0	27.8	32.6	29.5	31.1	31.1
45	36.1	26.8	34.8	28.4	33.4	30.2	31.8	31.8
46	36.9	27.4	35.5	29.1	34.1	30.9	32.5	32.5
47	37.7	28.0	36.3	29.7	34.9	31.5	33.2	33.2
48	38.5	28.6	37.1	30.3	35.6	32.2	33.9	33.9
49	39.3	29.2	37.9	31.0	36.3	32.9	34.7	34.7
50	40.2	29.8	38.7	31.7	37.0	33.6	35.4	35.4
51	41.0	30.4	39.5	32.3	37.8	34.3	36.1	36.1
52	41.8	31.0	40.3	32.9	38.5	35.0	36.8	36.8
53	42.6	31.6	41.1	33.6	39.2	35.6	37.5	37.5
54	43.4	32.2	41.8	34.3	40.0	36.3	38.2	38.2
55	44.2	32.8	42.6	34.9	40.8	37.0	38.9	38.9
56	45.0	33.4	43.4	35.6	41.7	37.6	39.6	39.6
57	45.8	34.0	44.2	36.2	42.8	38.3	40.3	40.3
58	46.6	34.6	45.0	36.8	43.0	39.0	41.0	41.0
59	47.4	35.2	45.8	37.4	43.8	39.6	41.7	41.7
60	48.2	35.7	46.4	38.1	44.5	40.3	42.4	42.4
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.
	4 $\frac{3}{4}$ Point.		4 $\frac{5}{2}$ Point.		4 $\frac{1}{4}$ Point.		4 Points.	

A TRAVERSE TABLE.

Diff.	1 Degree		2 Deg.		3 Deg.		4 Deg.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
1	1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.1
2	2.0	0.0	2.0	0.1	2.0	0.1	2.0	0.1
3	3.0	0.1	3.0	0.1	3.0	0.2	3.0	0.2
4	4.0	0.1	4.0	0.1	4.0	0.2	4.0	0.3
5	5.0	0.1	5.0	0.2	5.0	0.3	5.0	0.3
6	6.0	0.1	6.0	0.2	6.0	0.3	6.0	0.4
7	7.0	0.1	7.0	0.2	7.0	0.4	7.0	0.5
8	8.0	0.1	8.0	0.3	8.0	0.4	8.0	0.6
9	9.0	0.2	9.0	0.3	9.0	0.5	9.0	0.6
10	10.0	0.2	10.0	0.4	10.0	0.5	10.0	0.7
11	11.0	0.2	11.0	0.4	11.0	0.6	11.0	0.8
12	12.0	0.2	12.0	0.4	12.0	0.6	12.0	0.8
13	13.0	0.2	13.0	0.5	13.0	0.7	13.0	0.9
14	14.0	0.2	14.0	0.5	14.0	0.7	14.0	1.0
15	15.0	0.3	15.0	0.5	15.0	0.8	15.0	1.0
16	16.0	0.3	16.0	0.6	16.0	0.8	16.0	1.1
17	17.0	0.3	17.0	0.6	17.0	0.9	17.0	1.2
18	18.0	0.3	18.0	0.6	18.0	0.9	17.9	1.3
19	19.0	0.3	19.0	0.7	19.0	1.0	18.9	1.3
20	20.0	0.4	20.0	0.7	20.0	1.0	19.9	1.4
21	21.0	0.4	21.0	0.7	21.0	1.1	20.9	1.5
22	22.0	0.4	22.0	0.8	22.0	1.1	21.9	1.5
23	23.0	0.4	23.0	0.8	23.0	1.2	22.9	1.6
24	24.0	0.4	24.0	0.8	24.0	1.3	23.9	1.7
25	25.0	0.4	25.0	0.9	25.0	1.3	24.9	1.7
26	26.0	0.5	26.0	0.9	26.0	1.4	25.9	1.8
27	27.0	0.5	27.0	0.9	27.0	1.4	26.9	1.9
28	28.0	0.5	28.0	1.0	28.0	1.5	27.9	2.0
29	29.0	0.5	29.0	1.0	29.0	1.5	28.9	2.0
30	30.0	0.5	30.0	1.1	30.0	1.6	29.9	2.1
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.
	89 Deg.		88 Deg.		87 Deg.		86 Deg.	

A TRAVERSE TABLE.

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Diff.	1 Deg.		2 Deg.		3 Deg.		4 Deg.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
31	31.0	0.5	31.0	1.1	31.0	1.6	30.9	2.2
32	32.0	0.6	32.0	1.1	31.9	1.7	31.9	2.2
33	33.0	0.6	33.0	1.2	32.9	1.7	32.9	2.3
34	34.0	0.6	34.0	1.2	33.9	1.8	33.9	2.4
35	35.0	0.6	35.0	1.2	34.9	1.8	34.9	2.4
36	36.0	0.6	36.0	1.3	35.9	1.9	35.9	2.5
37	37.0	0.7	37.0	1.3	36.9	1.9	36.9	2.6
38	38.0	0.7	38.0	1.3	37.9	2.0	37.9	2.7
39	39.0	0.7	39.0	1.4	38.9	2.0	38.9	2.7
40	40.0	0.7	40.0	1.4	39.9	2.1	39.9	2.8
41	41.0	0.7	41.0	1.4	40.9	2.1	40.9	2.9
42	42.0	0.7	42.0	1.5	41.9	2.2	41.9	2.9
43	43.0	0.8	43.0	1.5	42.9	2.2	42.9	3.0
44	44.0	0.8	44.0	1.5	43.9	2.3	43.9	3.1
45	45.0	0.8	45.0	1.6	44.9	2.4	44.9	3.1
46	46.0	0.8	46.0	1.6	45.9	2.4	45.9	3.2
47	47.0	0.8	47.0	1.6	46.9	2.5	46.9	3.3
48	48.0	0.8	48.0	1.7	47.9	2.5	47.9	3.4
49	49.0	0.9	49.0	1.7	48.9	2.6	48.9	3.4
50	50.0	0.9	50.0	1.8	49.9	2.6	49.9	3.5
51	51.0	0.9	51.0	1.8	50.9	2.7	50.9	3.6
52	52.0	0.9	52.0	1.8	51.9	2.7	51.9	3.6
53	53.0	0.9	53.0	1.8	52.9	2.8	52.9	3.7
54	54.0	0.9	54.0	1.9	53.9	2.8	53.9	3.8
55	55.0	1.0	55.0	1.9	54.9	2.9	54.9	3.8
56	56.0	1.0	56.0	2.0	55.9	2.9	55.9	3.9
57	57.0	1.0	57.0	2.0	56.9	3.0	56.9	4.0
58	58.0	1.0	58.0	2.0	57.9	3.0	57.8	4.1
59	59.0	1.0	59.0	2.1	58.9	3.1	58.8	4.1
60	60.0	1.0	60.0	2.1	59.9	3.1	59.8	4.2
	Dep. Lat.		Dep. Lat.		Dep. Lat.		Dep. Lat.	
	89 Deg.		88 Deg.		87 Deg.		86 Deg.	

A TRAVERSE TABLE.

Dist.	5 Deg.		6 Deg.		7 Deg.		8 Deg.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
1	1.0	0.1	1.0	0.1	1.0	0.1	1.0	0.1
2	2.0	0.2	2.0	0.2	2.0	0.2	2.0	0.3
3	3.0	0.3	3.0	0.3	3.0	0.4	3.0	0.4
4	4.0	0.4	4.0	0.4	4.0	0.5	4.0	0.6
5	5.0	0.4	5.0	0.5	5.0	0.6	4.9	0.7
6	6.0	0.5	6.0	0.6	6.0	0.7	5.9	0.8
7	7.0	0.6	7.0	0.7	6.9	0.8	6.9	1.0
8	8.0	0.7	8.0	0.8	7.9	1.0	7.9	1.1
9	9.0	0.8	8.9	0.9	8.9	1.1	8.9	1.2
10	10.0	0.9	9.9	1.0	9.9	1.2	9.9	1.4
11	11.0	1.0	10.9	1.1	10.9	1.3	10.9	1.5
12	12.0	1.0	11.9	1.2	11.9	1.5	11.9	1.7
13	12.9	1.1	12.9	1.3	12.9	1.6	12.8	1.8
14	13.9	1.2	13.9	1.4	13.9	1.7	13.8	1.9
15	14.9	1.3	14.9	1.5	14.9	1.8	14.8	2.1
16	15.9	1.4	15.9	1.7	15.9	1.9	15.8	2.2
17	16.9	1.5	16.9	1.8	16.9	2.1	16.8	2.4
18	17.9	1.6	17.9	1.9	17.9	2.2	17.8	2.5
19	18.9	1.7	18.9	2.0	18.9	2.3	18.8	2.6
20	19.9	1.7	19.9	2.1	19.8	2.4	19.8	2.8
21	20.9	1.8	20.9	2.2	20.8	2.6	20.8	2.9
22	21.9	1.9	21.9	2.3	21.8	2.7	21.8	3.1
23	22.9	2.0	22.9	2.4	22.8	2.8	22.8	3.2
24	23.9	2.1	23.9	2.5	23.8	2.9	23.8	3.3
25	24.9	2.2	24.9	2.6	24.8	3.0	24.8	3.5
26	25.9	2.3	25.9	2.7	25.8	3.2	25.7	3.6
27	26.9	2.4	26.9	2.8	26.8	3.3	26.7	3.7
28	27.9	2.4	27.8	2.9	27.8	3.4	27.7	3.9
29	28.9	2.5	28.8	3.0	28.8	3.5	28.7	4.0
30	29.9	2.6	29.8	3.1	29.8	3.7	29.7	4.2
	Dep. Lat.		Dep. Lat.		Dep. Lat.		Dep. Lat.	
	85 Deg.		84 Deg.		83 Deg.		82 Deg.	

A TRAVERSE TABLE.

187

Diff.	5 Deg.		6 Deg.		7 Deg.		8 Deg.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
31	30.9	2.7	30.8	3.2	30.8	3.8	30.7	4.3
32	31.9	2.8	31.8	3.3	31.8	3.9	31.7	4.4
33	32.9	2.9	32.8	3.4	32.7	4.0	32.7	4.6
34	33.9	3.0	33.8	3.5	33.7	4.1	33.7	4.7
35	34.9	3.1	34.8	3.7	34.7	4.3	34.7	4.9
36	35.9	3.1	35.8	3.8	35.7	4.4	35.6	5.0
37	36.9	3.2	36.8	3.9	36.7	4.5	36.6	5.1
38	37.9	3.3	37.8	4.0	37.7	4.6	37.6	5.3
39	38.9	3.4	38.8	4.1	38.7	4.8	38.6	5.4
30	39.8	3.5	39.8	4.2	39.7	4.9	39.6	5.6
41	40.8	3.6	40.8	4.3	40.7	5.0	40.6	5.7
42	41.8	3.7	41.8	4.4	41.7	5.1	41.6	5.8
43	42.8	3.8	42.8	4.5	42.7	5.2	42.6	6.0
44	43.8	3.8	43.7	4.6	43.7	5.4	43.6	6.1
45	44.8	3.9	44.7	4.7	44.7	5.5	44.6	6.3
46	45.8	4.0	45.7	4.8	45.7	5.6	45.5	6.4
47	46.8	4.1	46.7	4.9	46.6	5.7	46.5	6.5
48	47.8	4.2	47.7	5.0	47.6	5.9	47.5	6.7
49	48.8	4.3	48.7	5.1	48.6	6.0	48.5	6.8
50	49.8	4.4	49.7	5.2	49.6	6.1	49.5	7.0
51	50.8	4.4	50.7	5.3	50.6	6.2	50.5	7.1
52	51.8	4.5	51.7	5.4	51.6	6.3	51.5	7.2
53	52.8	4.6	52.7	5.5	52.6	6.5	52.5	7.4
54	53.8	4.7	53.7	5.6	53.6	6.6	53.5	7.5
55	54.8	4.8	54.7	5.7	54.6	6.7	54.5	7.6
56	55.8	4.9	55.7	5.8	55.6	6.8	55.5	7.8
57	56.8	5.0	56.7	6.0	56.6	6.9	56.4	7.9
58	57.8	5.1	57.7	6.1	57.6	7.1	57.4	8.1
59	58.8	5.2	58.7	6.2	58.6	7.2	58.4	8.2
60	59.8	5.2	59.7	6.3	59.5	7.3	59.4	8.3
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.
	85 Deg.		84 Deg.		83 Deg.		82 Deg.	

A TRAVERSE TABLE.

Diff.	9 Deg		10 Deg.		11 Deg.		12 Deg.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
1	1.0	0.2	1.0	0.2	1.0	0.2	1.0	0.2
2	2.0	0.3	2.0	0.3	2.0	0.4	2.0	0.4
3	3.0	0.5	2.9	0.5	2.9	0.6	2.9	0.6
4	3.9	0.6	3.9	0.7	3.9	0.8	3.9	0.8
5	4.9	0.8	4.9	0.9	4.9	0.9	4.9	1.0
6	5.9	0.9	5.9	1.0	5.9	1.1	5.9	1.2
7	6.9	1.1	6.9	1.2	6.9	1.3	6.8	1.5
8	7.9	1.2	7.9	1.4	7.8	1.5	7.8	1.7
9	8.9	1.5	8.9	1.6	8.8	1.7	8.8	1.9
10	9.9	1.6	9.8	1.7	9.8	1.9	9.8	2.1
11	10.9	1.7	10.8	1.9	10.8	2.1	10.8	2.3
12	11.8	1.9	11.8	2.1	11.8	2.3	11.7	2.5
13	12.8	2.0	12.8	2.3	12.8	2.5	12.7	2.7
14	13.8	2.2	13.8	2.4	13.7	2.7	13.7	2.9
15	14.8	2.3	14.8	2.6	14.7	2.9	14.7	3.1
16	15.8	2.5	15.7	2.8	15.7	3.0	15.6	3.3
17	16.8	2.7	16.7	2.9	16.7	3.2	16.6	3.5
18	17.8	2.8	17.7	3.1	17.7	3.4	17.6	3.7
19	18.8	3.0	18.7	3.3	18.6	3.6	18.6	3.9
20	19.7	3.1	19.7	3.5	19.6	3.8	19.6	4.2
21	20.7	3.3	20.7	3.6	20.6	4.0	20.5	4.4
22	21.7	3.4	21.7	3.8	21.6	4.2	21.5	4.6
23	22.7	3.6	22.6	4.0	22.6	4.4	22.5	4.8
24	23.7	3.8	23.6	4.2	23.6	4.6	23.5	5.0
25	24.7	3.9	24.6	4.3	24.5	4.8	24.4	5.2
26	25.7	4.1	25.6	4.5	25.5	5.0	25.4	5.4
27	26.7	4.2	26.6	4.7	26.5	5.1	26.4	5.6
28	27.6	4.4	27.6	4.9	27.5	5.3	27.4	5.8
29	28.6	4.5	28.6	5.0	28.5	5.5	28.4	6.0
30	29.6	4.7	29.5	5.2	29.4	5.7	29.3	6.2
	Dep. Lat.		Dep. Lat.		Dep. Lat.		Dep. Lat.	
	81 Deg.		80 Deg.		79 Deg.		78 Deg.	

A TRAVERSE TABLE.

185

Dif.	9 Deg.		10 Deg.		11 Deg.		12 Deg.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
31	30.6	4.9	30.5	5.4	30.4	5.9	30.3	6.4
32	31.6	5.0	31.5	5.5	31.4	6.1	31.3	6.6
33	32.6	5.2	32.5	5.7	32.4	6.3	32.3	6.9
34	33.6	5.3	33.5	5.9	33.4	6.5	33.2	7.1
35	34.6	5.5	34.5	6.1	34.4	6.7	34.2	7.3
36	35.5	5.6	35.4	6.2	35.3	6.9	35.2	7.5
37	36.5	5.8	36.4	6.4	36.3	7.1	36.2	7.7
38	37.5	6.0	37.4	6.6	37.3	7.2	37.2	7.9
39	38.5	6.1	38.4	6.8	38.3	7.4	38.1	8.1
40	39.5	6.3	39.4	6.9	39.3	7.6	39.1	8.3
41	40.5	6.4	40.4	7.1	40.2	7.8	40.1	8.5
42	41.5	6.6	41.4	7.3	41.2	8.0	41.1	8.7
43	42.5	6.7	42.3	7.5	42.2	8.2	42.1	8.9
44	43.5	6.9	43.3	7.7	43.2	8.4	43.0	9.1
45	44.4	7.0	44.3	7.8	44.2	8.6	44.0	9.4
46	45.4	7.2	45.3	7.9	45.2	8.8	45.0	9.6
47	46.4	7.3	46.3	8.1	46.1	9.0	46.0	9.8
48	47.4	7.5	47.3	8.3	47.1	9.2	47.0	10.0
49	48.4	7.7	48.3	8.5	48.1	9.3	47.9	10.2
50	49.4	7.8	49.3	8.7	49.1	9.5	48.9	10.4
51	50.4	8.0	50.2	8.8	50.1	9.7	49.9	10.6
52	51.4	8.1	51.2	9.0	51.0	9.9	50.9	10.8
53	52.3	8.3	52.2	9.2	52.0	10.1	51.8	11.0
54	53.3	8.4	53.2	9.4	53.0	10.3	52.8	11.2
55	54.3	8.6	54.2	9.5	54.0	10.5	53.8	11.4
56	55.3	8.7	55.1	9.7	55.0	10.7	54.8	11.6
57	56.3	8.9	56.1	9.9	56.0	10.9	55.8	11.8
58	57.3	9.1	57.1	10.1	56.9	11.1	56.7	12.1
59	58.3	9.2	58.1	10.2	57.9	11.3	57.7	12.3
60	59.3	9.4	59.1	10.4	58.9	11.4	58.7	12.5
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.
	81 Deg.		80 Deg.		79 Deg.		78 Deg.	

A TRAVERSE TABLE.

Diff.	13 Deg.		14 Deg.		15 Deg.		16 Deg.	
	Lat. Dep.		Lat. Dep.		Lat. Dep.		Lat. Dep.	
1	1.0	0.2	1.0	0.2	1.0	0.3	1.0	0.3
2	1.9	0.4	1.9	0.5	1.9	0.5	1.9	0.5
3	2.9	0.7	2.9	0.7	2.9	0.8	2.9	0.8
4	3.9	0.9	3.9	1.0	3.9	1.0	3.8	1.1
5	4.9	1.1	4.8	1.2	4.8	1.3	4.8	1.4
6	5.8	1.3	5.8	1.4	5.8	1.5	5.7	1.6
7	6.8	1.6	6.8	1.7	6.8	1.8	6.7	1.9
8	7.8	1.8	7.8	1.9	7.7	2.1	7.7	2.2
9	8.8	2.0	8.7	2.2	8.7	2.3	8.6	2.5
10	9.7	2.2	9.7	2.5	9.7	2.6	9.6	2.8
11	10.7	2.5	10.7	2.7	10.6	2.8	10.6	3.0
12	11.7	2.7	11.6	2.9	11.6	3.1	11.5	3.3
13	12.7	2.9	12.6	3.1	12.6	3.4	12.5	3.6
14	13.6	3.1	13.6	3.4	13.5	3.6	13.5	3.9
15	14.6	3.4	14.5	3.6	14.5	3.9	14.4	4.1
16	15.6	3.6	15.5	3.9	15.5	4.1	15.4	4.4
17	16.6	3.8	16.5	4.1	16.4	4.4	16.3	4.7
18	17.5	4.0	17.5	4.4	17.4	4.7	17.3	5.0
19	18.5	4.2	18.4	4.6	18.4	4.9	18.3	5.2
20	19.5	4.5	19.4	4.8	19.3	5.2	19.2	5.5
21	20.5	4.7	20.4	5.1	20.3	5.4	20.2	5.8
22	21.4	4.9	21.3	5.3	21.2	5.7	21.1	6.1
23	22.4	5.2	22.3	5.6	22.2	6.0	22.1	6.3
24	23.4	5.4	23.3	5.8	23.2	6.2	23.1	6.6
25	24.3	5.6	24.3	6.0	24.1	6.5	24.0	6.9
26	25.3	5.8	25.2	6.3	25.1	6.7	24.9	7.2
27	26.3	6.1	26.2	6.5	26.1	7.0	25.9	7.4
28	27.3	6.3	27.2	6.8	27.0	7.2	26.9	7.7
29	28.2	6.5	28.1	7.0	28.0	7.5	27.8	8.0
30	29.2	6.7	29.1	7.3	29.0	7.8	28.8	8.3
	Dep. Lat.		Dep. Lat.		Dep. Lat.		Dep. Lat.	
	77 Deg.		76 Deg.		75 Deg.		74 Deg.	

A TRAVERSE TABLE.

187

Dit.	13 Deg.		14 Deg.		15 Deg.		16 Deg.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
31	30.2	7.0	30.1	7.5	29.9	8.0	29.8	8.5
32	31.2	7.2	31.0	7.7	30.9	8.3	30.7	8.8
33	32.1	7.4	32.0	8.0	31.9	8.5	31.7	9.1
34	33.1	7.6	33.0	8.2	32.8	8.8	32.7	9.4
35	34.1	7.9	34.0	8.5	33.8	9.0	33.6	9.6
36	35.1	8.1	34.9	8.7	34.8	9.3	34.6	9.9
37	36.0	8.3	35.9	9.0	35.7	9.6	35.6	10.2
38	37.0	8.5	36.9	9.2	36.7	9.8	36.5	10.5
39	38.0	8.8	37.8	9.4	37.7	10.1	37.5	10.7
40	39.0	9.0	38.8	9.7	38.6	10.3	38.4	11.0
41	39.9	9.2	39.8	9.9	39.6	10.6	39.4	11.3
42	40.9	9.4	40.7	10.2	40.6	10.9	40.4	11.6
43	41.9	9.7	41.7	10.4	41.5	11.1	41.3	11.8
44	42.9	9.9	42.7	10.6	42.5	11.4	42.3	12.1
45	43.8	10.1	43.7	10.9	43.5	11.6	43.2	12.4
46	44.8	10.3	44.6	11.1	44.4	11.9	44.2	12.7
47	45.8	10.6	45.6	11.4	45.4	12.2	45.2	12.9
48	46.7	10.8	46.5	11.6	46.4	12.4	46.1	13.2
49	47.7	11.0	47.5	11.9	47.3	12.7	47.1	13.5
50	48.7	11.2	48.3	12.1	48.3	12.9	48.1	13.8
51	49.7	11.5	49.5	12.3	49.3	13.2	49.0	14.0
52	50.7	11.7	50.5	12.6	50.2	13.5	49.9	14.3
53	51.6	11.9	51.4	12.8	51.2	13.7	50.9	14.6
54	52.6	12.1	52.4	13.1	52.2	14.0	51.9	14.9
55	53.6	12.4	53.4	13.3	53.1	14.2	52.9	15.2
56	54.5	12.6	54.3	13.5	54.1	14.5	53.8	15.4
57	55.5	12.8	55.3	13.8	55.1	14.8	54.8	15.7
58	56.5	13.0	56.3	14.0	56.0	15.0	55.8	16.0
59	57.5	13.3	57.2	14.3	57.0	15.3	56.7	16.3
60	58.5	13.5	58.2	14.5	58.0	15.5	57.7	16.5
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.
	77 Deg.		76 Deg.		75 Deg.		74 Deg.	

A TRAVERSE TABLE.

Diff.	17 Deg.		18 Deg.		19 Deg.		20 Deg.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
1	1.0	0.3	0.9	0.3	0.9	0.3	0.9	0.3
2	1.9	0.6	1.9	0.6	1.9	0.6	1.9	0.7
3	2.9	0.9	2.8	0.9	2.8	1.0	2.8	1.0
4	3.8	1.2	3.8	1.2	3.8	1.3	3.8	1.4
5	4.8	1.5	4.8	1.5	4.7	1.6	4.7	1.7
6	5.7	1.7	5.7	1.8	5.7	1.9	5.6	2.0
7	6.7	2.0	6.7	2.2	6.6	2.3	6.6	2.4
8	7.6	2.3	7.6	2.5	7.6	2.6	7.5	2.7
9	8.6	2.6	8.6	2.8	8.5	2.9	8.5	3.1
10	9.6	2.9	9.5	3.1	9.5	3.3	9.4	3.4
11	10.5	3.2	10.5	3.4	10.4	3.6	10.3	3.8
12	11.5	3.5	11.4	3.7	11.3	3.9	11.3	4.1
13	12.4	3.8	12.4	4.0	12.3	4.2	12.2	4.4
14	13.4	4.1	13.3	4.3	13.2	4.6	13.2	4.8
15	14.3	4.4	14.3	4.6	14.2	4.9	14.1	5.1
16	15.3	4.7	15.2	4.9	15.1	5.2	15.0	5.4
17	16.3	5.0	16.2	5.2	16.1	5.5	16.0	5.8
18	17.2	5.3	17.1	5.6	17.0	5.9	16.9	6.2
19	18.2	5.5	18.1	5.9	18.0	6.1	17.9	6.5
20	19.1	5.8	19.0	6.2	18.9	6.5	18.8	6.8
21	20.1	6.1	20.0	6.5	19.9	6.8	19.7	7.2
22	21.0	6.4	20.9	6.8	20.8	7.2	20.7	7.5
23	22.0	6.7	21.9	7.1	21.7	7.5	21.6	7.9
24	22.9	7.0	22.8	7.4	22.7	7.8	22.5	8.2
25	23.9	7.3	23.8	7.7	23.6	8.1	23.5	8.5
26	24.9	7.6	24.7	8.0	24.6	8.5	24.4	8.9
27	25.8	7.9	25.7	8.3	25.5	8.8	25.4	9.2
28	26.8	8.2	26.6	8.6	26.5	9.1	26.3	9.6
29	27.7	8.5	27.6	9.0	27.4	9.4	27.2	9.9
30	28.7	8.8	28.5	9.3	28.4	9.8	28.2	10.3
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.
	73 Deg.		72 Deg.		71 Deg.		70 Deg.	

A TRAVERSE TABLE.

189

Diff.	17 Deg.		18 Deg.		19 Deg.		20 Deg.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
31	29.6	9.1	29.5	9.6	29.3	10.1	29.1	10.6
32	30.6	9.3	30.4	10.0	30.3	10.4	30.0	10.9
33	31.6	9.6	31.4	10.2	31.2	10.7	30.9	11.3
34	32.5	9.9	32.3	10.5	32.1	11.1	31.9	11.6
35	33.5	10.2	33.3	10.8	33.1	11.4	32.9	12.0
36	34.4	10.5	34.2	11.1	34.0	11.7	33.8	12.3
37	35.4	10.8	35.2	11.4	35.0	12.1	34.8	12.6
38	36.3	11.1	36.1	11.7	35.9	12.4	35.7	13.0
39	37.3	11.4	37.1	12.0	36.9	12.7	36.6	13.3
40	38.2	11.7	38.0	12.4	37.8	13.0	37.6	13.7
41	39.2	12.0	39.0	12.7	38.8	13.3	38.5	14.0
42	40.2	12.3	39.9	13.0	39.7	13.7	39.5	14.4
43	41.1	12.6	40.9	13.3	40.7	14.0	40.4	14.7
44	42.1	12.9	41.8	13.6	41.6	14.3	41.3	15.0
45	43.0	13.1	42.8	13.9	42.6	14.6	42.3	15.4
46	44.0	13.4	43.7	14.2	43.5	15.0	43.2	15.7
47	44.9	13.7	44.7	14.5	44.4	15.3	44.2	16.1
48	45.9	14.0	45.6	14.8	45.4	15.6	45.1	16.4
49	46.9	14.3	46.6	15.1	46.3	15.9	46.0	16.8
50	47.8	14.6	47.5	15.4	47.3	16.3	47.0	17.1
51	48.8	14.9	48.5	15.8	48.2	16.6	47.9	17.4
52	49.7	15.2	49.4	16.1	49.2	16.9	48.9	17.8
53	50.7	15.5	50.4	16.4	50.1	17.3	49.8	18.1
54	51.6	15.8	51.3	16.7	51.1	17.6	50.7	18.5
55	52.6	16.1	52.3	17.0	52.0	17.9	51.7	18.8
56	53.5	16.4	53.3	17.3	52.9	18.2	52.6	19.1
57	54.4	16.7	54.2	17.6	53.9	18.6	53.6	19.5
58	55.4	17.0	55.2	17.9	54.8	18.9	54.5	19.8
59	56.4	17.2	56.1	18.2	55.8	19.1	55.4	20.2
60	57.4	17.5	57.1	18.5	56.7	19.5	56.4	20.5
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.
	73 Deg.		72 Deg.		71 Deg.		70 Deg.	

A TRAVERSE TABLE.

Dist.	21 Deg.		22 Deg.		23 Deg.		24 Deg.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
1	0.9	0.4	0.9	0.4	0.9	0.4	0.9	0.4
2	1.9	0.7	1.8	0.7	1.8	0.8	1.8	0.8
3	2.8	1.1	2.8	1.1	2.8	1.2	2.7	1.2
4	3.7	1.4	3.7	1.5	3.7	1.6	3.6	1.6
5	4.7	1.8	4.6	1.9	4.6	1.9	4.6	2.0
6	5.6	2.1	5.6	2.2	5.5	2.3	5.5	2.4
7	6.5	2.5	6.5	2.6	6.4	2.7	6.4	2.8
8	7.5	2.9	7.4	3.0	7.4	3.1	7.3	3.2
9	8.4	3.2	8.3	3.4	8.3	3.5	8.2	3.7
10	9.3	3.6	9.2	3.7	9.2	3.9	9.1	4.1
11	10.3	3.9	10.2	4.1	10.1	4.3	10.0	4.5
12	11.2	4.3	11.1	4.5	11.0	4.7	11.0	4.9
13	12.1	4.7	12.0	4.9	12.0	5.1	11.9	5.3
14	13.1	5.0	13.0	5.2	12.9	5.5	12.8	5.7
15	14.0	5.4	13.9	5.6	13.8	5.9	13.7	6.1
16	14.9	5.8	14.8	6.0	14.7	6.2	14.6	6.5
17	15.9	6.1	15.8	6.4	15.6	6.6	15.5	6.9
18	16.8	6.4	16.7	6.7	16.6	7.0	16.4	7.3
19	17.7	6.8	17.6	7.1	17.5	7.4	17.4	7.7
20	18.7	7.2	18.5	7.5	18.4	7.8	18.3	8.1
21	19.6	7.5	19.5	7.9	19.3	8.2	19.2	8.5
22	20.5	7.9	20.4	8.2	20.2	8.6	20.1	8.9
23	21.5	8.2	21.3	8.6	21.2	9.0	21.0	9.3
24	22.4	8.6	22.2	9.0	22.1	9.4	21.9	9.8
25	23.3	9.0	23.2	9.4	23.0	9.8	22.8	10.2
26	24.3	9.3	24.1	9.7	23.9	10.2	23.7	10.6
27	25.2	9.7	25.0	10.1	24.8	10.5	24.7	11.0
28	26.1	10.0	26.0	10.5	25.8	10.9	25.6	11.4
29	27.1	10.4	26.9	10.9	26.7	11.3	26.5	11.8
30	28.0	10.7	27.8	11.2	27.6	11.7	27.4	12.2
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.
	69 Deg.		68 Deg.		67 Deg.		66 Deg.	

A TRAVERSE TABLE.

191

Diff.	21 Deg.		22 Deg.		23 Deg.		24 Deg.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
31	28.9	11.1	28.7	11.6	28.5	12.1	28.3	12.6
32	29.9	11.5	29.7	12.0	29.5	12.5	29.2	13.0
33	30.8	11.8	30.6	12.4	30.4	12.9	30.1	13.4
34	31.7	12.2	31.5	12.7	31.3	13.3	31.1	13.8
35	32.7	12.5	32.4	13.1	32.2	13.7	32.0	14.2
36	33.6	12.9	33.2	13.5	33.1	14.1	32.9	14.7
37	34.5	13.3	34.1	13.9	34.1	14.4	33.8	15.1
38	35.5	13.6	35.0	14.2	35.0	14.8	34.7	15.5
39	36.4	14.0	36.9	14.6	35.9	15.2	35.6	15.9
40	37.3	14.3	37.9	15.0	36.8	15.6	36.5	16.3
41	38.3	14.7	38.0	15.3	37.7	16.0	37.5	16.7
42	39.2	15.1	38.9	15.7	38.7	16.4	38.4	17.1
43	40.1	15.4	39.9	16.1	39.6	16.8	39.3	17.5
44	41.1	15.8	40.8	16.5	40.5	17.2	40.2	17.9
45	42.0	16.1	41.7	16.8	41.4	17.6	41.1	18.3
46	42.9	16.5	42.6	17.2	42.3	18.0	42.0	18.7
47	43.9	16.7	43.6	17.6	43.3	18.4	42.9	19.1
48	44.8	17.1	44.5	18.0	44.2	18.8	43.8	19.5
49	45.7	17.5	45.4	18.3	45.1	19.2	44.8	19.9
50	46.7	17.9	46.4	18.7	46.0	19.5	45.7	20.3
51	47.6	18.3	47.3	19.1	46.9	19.9	46.6	20.7
52	48.5	18.6	48.2	19.4	47.9	20.3	47.5	21.1
53	49.5	19.0	49.1	19.8	48.8	20.7	48.4	21.5
54	50.4	19.3	50.1	20.2	49.7	21.1	49.3	22.0
55	51.3	19.7	51.0	20.6	50.6	21.5	50.2	22.4
56	52.3	20.1	51.9	21.0	51.5	21.9	51.2	22.8
57	53.2	20.4	52.8	21.3	52.5	22.3	52.1	23.2
58	54.1	20.8	53.8	21.7	53.4	22.7	53.0	23.6
59	55.1	21.1	54.7	22.1	54.3	23.0	53.9	24.0
60	56.0	21.5	55.6	22.5	55.2	23.4	54.8	24.4
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.
	69 Deg.		68 Deg.		67 Deg.		66 Deg.	

A TRAVERSE TABLE.

Diff.	25 Deg.		26 Deg.		27 Deg.		28 Deg.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
1	0.0	0.4	0.9	0.4	0.9	0.4	0.9	0.5
2	1.8	0.8	1.8	0.9	1.8	0.9	1.8	0.9
3	2.7	1.3	2.7	1.3	2.7	1.4	2.6	1.4
4	3.6	1.7	3.6	1.7	3.6	1.8	3.5	1.9
5	4.5	2.1	4.5	2.2	4.5	2.3	4.4	2.3
6	5.4	2.5	5.4	2.6	5.3	2.7	5.3	2.8
7	6.3	3.0	6.3	3.1	6.2	3.2	6.2	3.3
8	7.2	3.4	7.2	3.5	7.1	3.6	7.1	3.8
9	8.2	3.8	8.1	3.9	8.0	4.1	7.9	4.2
10	9.1	4.2	9.0	4.4	8.9	4.5	8.8	4.7
11	10.0	4.6	9.9	4.8	9.8	5.0	9.7	5.2
12	10.9	5.1	10.8	5.3	10.7	5.4	10.6	5.6
13	11.8	5.5	11.7	5.7	11.6	5.8	11.5	6.1
14	12.7	5.9	12.6	6.1	12.5	6.3	12.4	6.6
15	13.6	6.3	13.5	6.6	13.4	6.8	13.2	7.0
16	14.5	6.8	14.4	7.0	14.3	7.3	14.1	7.5
17	15.4	7.2	15.3	7.4	15.1	7.7	15.0	8.0
18	16.3	7.6	16.2	7.9	16.0	8.2	15.9	8.4
19	17.2	8.0	17.1	8.3	16.9	8.6	16.8	8.9
20	18.1	8.4	18.0	8.8	17.8	9.1	17.7	9.4
21	19.0	8.9	18.9	9.2	18.7	9.5	18.5	9.9
22	19.9	9.3	19.8	9.7	19.6	10.0	19.4	10.3
23	20.8	9.7	20.7	10.1	20.5	10.4	20.3	10.8
24	21.7	10.1	21.6	10.5	21.4	10.9	21.2	11.3
25	22.7	10.6	22.5	11.0	22.3	11.3	22.1	11.7
26	23.6	11.0	23.4	11.4	23.2	11.8	23.0	12.2
27	24.5	11.4	24.3	11.8	24.1	12.3	23.8	12.7
28	25.4	11.8	25.2	12.3	24.9	12.7	24.7	13.1
29	26.3	12.3	26.1	12.7	25.8	13.2	25.6	13.6
30	27.2	12.7	27.0	13.1	26.7	13.6	26.5	14.1
	Dep Lat.		Dep Lat.		Dep Lat.		Dep Lat.	
	65 Deg.		64 Deg.		63 Deg.		62 Deg.	

A TRAVERSE TABLE.

193

Dif.	25 Deg.		26 Deg.		27 Deg.		28 Deg.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
31	28.1	13.1	27.9	13.6	27.6	14.1	27.4	14.5
32	29.0	13.5	28.8	14.0	28.5	14.5	28.2	15.0
33	29.9	13.9	29.7	14.4	29.4	14.9	29.1	15.5
34	30.8	14.4	30.6	14.9	30.3	15.4	30.0	16.0
35	31.7	14.8	31.5	15.3	31.2	15.9	30.9	16.4
36	32.6	15.2	32.4	15.8	32.1	16.3	31.8	16.9
37	33.5	15.6	33.2	16.2	33.0	16.8	32.7	17.4
38	34.4	16.0	34.1	16.6	33.9	17.2	33.5	17.0
39	35.3	16.5	35.0	17.1	34.7	17.7	34.4	18.4
40	36.2	16.9	35.9	17.5	35.6	18.2	35.3	18.8
41	37.2	17.3	36.8	18.0	36.5	18.6	36.2	19.2
42	38.1	17.7	37.7	18.4	37.4	19.1	37.1	19.7
43	39.0	18.2	38.6	18.8	38.3	19.5	38.0	20.1
44	39.9	18.6	39.5	19.3	39.2	20.0	38.8	20.6
45	40.8	19.0	40.4	19.7	40.1	20.4	39.7	21.1
46	41.7	19.4	41.3	20.2	41.0	20.9	40.6	21.6
47	42.6	19.9	42.2	20.6	41.9	21.3	41.5	22.1
48	43.5	20.3	43.1	21.0	42.8	21.8	42.4	22.5
49	44.4	20.7	44.0	21.5	43.7	22.2	43.3	23.1
50	45.3	21.1	44.9	21.9	44.5	22.7	44.1	23.5
51	46.2	21.5	45.8	22.3	45.4	23.2	45.0	23.9
52	47.1	22.0	46.7	22.8	46.3	23.6	45.9	24.4
53	48.0	22.4	47.6	23.2	47.2	24.1	46.8	24.9
54	48.9	22.8	48.5	23.7	48.1	24.5	47.7	25.3
55	49.8	23.2	49.4	24.1	49.0	25.0	48.6	25.8
56	50.7	23.7	50.3	24.5	49.9	25.4	49.4	26.3
57	51.7	24.1	51.2	25.0	50.8	25.9	50.3	26.8
58	52.6	24.5	52.1	25.4	51.7	26.3	51.2	27.2
59	53.5	24.9	53.0	25.9	52.6	26.8	52.1	27.7
60	54.4	25.4	53.9	26.3	53.5	27.2	53.0	28.2
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.
	65 Deg.		64 Deg.		63 Deg.		62 Deg.	

A TRAVERSE TABLE.

Dir.	29 Deg.		30 Deg.		31 Deg.		32 Deg.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
1	0.9	0.5	0.9	0.5	0.9	0.5	0.8	0.5
2	1.7	1.0	1.7	1.0	1.7	1.0	1.7	1.1
3	2.6	1.4	2.6	1.5	2.6	1.5	2.5	1.6
4	3.5	1.9	3.5	2.0	3.4	2.1	3.4	2.1
5	4.4	2.4	4.3	2.5	4.3	2.6	4.2	2.6
6	5.2	2.9	5.2	3.0	5.2	3.1	5.1	3.2
7	6.1	3.4	6.1	3.5	6.1	3.6	5.9	3.7
8	7.0	3.9	6.9	4.0	6.9	4.1	6.8	4.2
9	7.9	4.4	7.8	4.5	7.7	4.6	7.6	4.8
10	8.7	4.8	8.7	5.0	8.6	5.1	8.5	5.3
11	9.6	5.3	9.5	5.5	9.4	5.7	9.3	5.8
12	10.5	5.8	10.4	6.0	10.3	6.2	10.2	6.4
13	11.4	6.3	11.3	6.5	11.1	6.7	11.0	6.9
14	12.2	6.8	12.1	7.0	12.0	7.2	11.9	7.4
15	13.1	7.3	13.0	7.5	12.9	7.7	12.7	7.9
16	14.0	7.7	13.9	8.0	13.7	8.2	13.6	8.5
17	14.9	8.2	14.7	8.5	14.6	8.8	14.4	9.0
18	15.7	8.7	15.6	9.0	15.4	9.3	15.3	9.5
19	16.6	9.2	16.5	9.5	16.3	9.8	16.1	10.1
20	17.5	9.7	17.4	10.0	17.1	10.3	17.0	10.6
21	18.4	10.2	18.2	10.5	18.0	10.8	17.8	11.1
22	19.2	10.7	19.0	11.0	18.9	11.3	18.6	11.7
23	20.1	11.1	19.9	11.5	19.7	11.8	19.5	12.2
24	21.0	11.6	20.8	12.0	20.6	12.4	20.3	12.7
25	21.9	12.1	21.6	12.5	21.4	12.9	21.2	13.2
26	22.7	12.6	22.5	13.0	22.3	13.4	22.0	13.8
27	23.6	13.1	23.4	13.5	23.1	13.9	22.9	14.3
28	24.5	13.6	24.2	14.0	24.0	14.4	23.7	14.8
29	25.4	14.1	25.1	14.5	24.9	14.9	24.6	15.4
30	26.2	14.5	26.0	15.0	25.7	15.4	25.4	15.9
	Dep. Lat.		Dep. Lat.		Dep. Lat.		Dep. Lat.	
	61 Deg.		60 Deg.		59 Deg.		58 Deg.	

A TRAVERSE TABLE.

195

Diff.	29 Deg.		30 Deg.		31 Deg.		32 Deg.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
31	27.1	15.0	26.8	15.5	26.6	16.0	26.3	16.4
32	28.0	15.5	27.7	16.0	27.4	16.5	27.1	17.0
33	28.9	16.0	28.6	16.5	28.3	17.0	28.0	17.5
34	29.7	16.5	29.5	17.0	29.1	17.5	28.8	18.0
35	30.6	17.0	30.3	17.5	30.0	18.0	29.7	18.5
36	31.5	17.4	31.2	18.0	30.9	18.5	30.5	19.1
37	32.4	17.9	32.0	18.5	31.7	19.1	31.4	19.6
38	33.2	18.4	32.9	19.0	32.6	19.6	32.2	20.1
39	34.1	18.9	33.8	19.5	33.4	20.1	33.1	20.7
40	35.0	19.4	34.6	20.0	34.3	20.6	33.9	21.2
41	35.8	19.9	35.5	20.5	35.1	21.1	34.8	21.7
42	36.7	20.4	36.4	21.0	36.0	21.6	35.6	22.3
43	37.6	20.8	37.2	21.5	36.9	22.1	36.5	22.8
44	38.5	21.3	38.1	22.0	37.7	22.6	37.3	23.3
45	39.3	21.8	39.0	22.5	38.6	23.2	38.1	23.8
46	40.2	22.3	39.8	23.0	39.4	23.7	39.0	24.4
47	41.1	22.8	40.7	23.5	40.3	24.2	39.9	24.9
48	42.0	23.3	41.6	24.0	41.1	24.7	40.7	25.4
49	42.8	23.7	42.4	24.5	42.0	25.2	41.5	26.0
50	43.7	24.2	43.3	25.0	42.9	25.7	42.4	26.5
51	44.6	24.7	44.2	25.5	43.7	26.3	43.2	27.0
52	45.5	25.2	45.0	26.0	44.6	26.8	44.1	27.6
53	46.3	25.7	45.9	26.5	45.4	27.3	44.9	28.1
54	47.2	26.2	46.8	27.0	46.3	27.8	45.8	28.6
55	48.1	26.7	47.6	27.5	47.1	28.3	46.6	29.1
56	49.9	27.1	48.5	28.0	48.0	28.8	47.5	29.7
57	49.8	27.6	49.4	28.5	48.9	29.4	48.3	30.2
58	50.7	28.1	50.2	29.0	49.7	29.9	49.2	30.7
59	51.6	28.6	51.1	29.5	50.6	30.4	50.0	31.3
60	52.5	29.1	52.0	30.0	51.4	30.9	50.9	31.8
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.
	61 Deg.		60 Deg.		59 Deg.		58 Deg.	

A TRAVERSE TABLE.

Dift.	33 Deg.		34 Deg.		35 Deg.		36 Deg.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
1	0.8	0.5	0.8	0.6	0.8	0.6	0.8	0.6
2	1.7	1.1	1.7	1.1	1.6	1.1	1.6	1.2
3	2.5	1.6	2.5	1.7	2.5	1.7	2.4	1.8
4	3.4	2.2	3.3	2.2	3.3	2.3	3.2	2.3
5	4.3	2.7	4.1	2.8	4.1	2.9	4.0	2.9
6	5.0	3.3	5.0	3.4	4.9	3.4	4.8	3.5
7	5.9	3.8	5.8	3.9	5.7	4.0	5.7	4.1
8	6.7	4.4	6.6	4.5	6.5	4.6	6.5	4.7
9	7.5	4.9	7.5	5.0	7.4	5.2	7.3	5.3
10	8.4	5.4	8.3	5.6	8.2	5.7	8.1	5.9
11	9.2	6.0	9.1	6.1	9.0	6.3	8.9	6.5
12	10.1	6.5	9.9	6.7	9.8	6.9	9.7	7.0
13	10.9	7.1	10.8	7.3	10.6	7.5	10.5	7.6
14	11.7	7.6	11.6	7.8	11.5	8.0	11.3	8.2
15	12.6	8.2	12.4	8.4	12.3	8.6	12.1	8.8
16	13.4	8.7	13.3	8.9	13.1	9.2	12.9	9.4
17	14.3	9.3	14.1	9.5	13.9	9.8	13.7	10.0
18	15.1	9.8	14.9	10.1	14.7	10.3	14.6	10.6
19	15.9	10.3	15.7	10.6	15.6	10.9	15.4	11.2
20	16.8	10.9	16.6	11.2	16.4	11.5	16.2	11.8
21	17.6	11.4	17.4	11.7	17.2	12.0	17.0	12.3
22	18.5	12.0	18.2	12.3	18.0	12.6	17.8	12.9
23	19.3	12.5	19.0	12.8	18.8	13.2	18.6	13.5
24	20.1	13.1	19.9	13.4	19.7	13.8	19.4	14.1
25	21.0	13.6	20.7	14.0	20.5	14.3	20.2	14.7
26	21.8	14.2	21.5	14.5	21.3	14.9	21.0	15.3
27	22.6	14.7	22.4	15.1	22.1	15.5	21.8	15.9
28	23.5	15.2	23.2	15.6	22.9	16.1	22.6	16.5
29	24.3	15.8	24.0	16.2	23.8	16.6	23.5	17.0
30	25.2	16.3	24.9	16.8	24.6	17.2	24.3	17.6
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.
	57 Deg.		56 Deg.		55 Deg.		54 Deg.	

A TRAVERSE TABLE.

197

Diff.	33 Deg.		34 Deg.		35 Deg.		36 Deg.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
31	26.0	16.9	25.7	17.3	25.4	17.8	25.1	18.2
32	26.8	17.4	26.5	17.9	26.2	18.3	25.9	18.8
33	27.7	18.0	27.4	18.4	27.0	18.9	26.7	19.4
34	28.5	18.5	28.2	19.0	27.9	19.5	27.5	20.0
35	29.4	19.1	29.0	19.6	28.7	20.1	28.3	20.6
36	30.2	19.6	29.8	20.1	29.5	20.6	29.1	21.2
37	31.0	20.1	30.7	20.7	30.3	21.2	29.9	21.7
38	31.9	20.7	31.5	21.2	31.1	21.8	30.7	22.3
39	32.7	21.2	32.3	21.8	32.0	22.3	31.5	22.9
40	33.5	21.8	33.2	22.4	32.8	22.9	32.4	23.5
41	34.4	22.3	34.0	22.9	33.6	23.5	33.2	24.1
42	35.2	22.9	34.8	23.5	34.4	24.1	34.0	24.7
43	36.1	23.4	35.6	24.0	35.2	24.6	34.8	25.3
44	36.9	24.0	36.5	24.6	36.0	25.2	35.6	25.9
45	37.7	24.5	37.3	25.2	36.9	25.8	36.4	26.4
46	38.6	25.0	38.1	25.7	37.7	26.4	37.2	27.0
47	39.4	25.6	39.0	26.3	38.5	27.0	38.0	27.6
48	40.2	26.1	39.8	26.8	39.3	27.6	38.8	28.2
49	41.1	26.7	40.6	27.4	40.1	28.2	39.6	28.8
50	41.9	27.2	41.4	28.0	41.0	28.8	40.4	29.4
51	42.8	27.8	42.3	28.5	41.8	29.2	41.3	30.0
52	43.6	28.3	43.1	29.1	42.6	29.8	42.1	30.6
53	44.5	28.9	43.9	29.6	43.4	30.4	42.9	31.2
54	45.3	29.4	44.7	30.2	44.2	31.0	43.7	31.7
55	46.1	30.0	45.6	30.7	45.1	31.5	44.5	32.3
56	47.0	30.5	46.4	31.3	45.9	32.1	45.3	32.9
57	47.8	31.0	47.3	31.9	46.7	32.7	46.1	33.5
58	48.7	31.6	48.1	32.4	47.5	33.3	46.9	34.1
59	49.5	32.1	48.9	33.0	48.3	33.8	47.7	34.7
60	50.3	32.7	49.7	33.5	49.1	34.4	48.5	35.3
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.
	57 Deg.		56 Deg.		55 Deg.		54 Deg.	

A TRAVERSE TABLE.

Diff.	37 Deg.		38 Deg.		39 Deg.		40 Deg.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
1	0.8	0.6	0.8	0.6	0.8	0.7	0.8	0.6
2	1.6	1.2	1.6	1.2	1.5	1.3	1.5	1.3
3	2.4	1.8	2.4	1.8	2.3	1.9	2.3	1.9
4	3.2	2.4	3.1	2.5	3.1	2.5	3.1	2.6
5	4.0	3.0	3.9	3.1	3.9	3.1	3.8	3.2
6	4.8	3.6	4.7	3.7	4.6	3.8	4.6	3.9
7	5.6	4.2	5.5	4.3	5.4	4.4	5.4	4.5
8	6.4	4.8	6.3	4.9	6.2	5.0	6.1	5.1
9	7.2	5.4	7.1	5.5	7.0	5.7	6.9	5.8
10	8.0	6.0	7.9	6.2	7.8	6.3	7.7	6.4
11	8.8	6.6	8.7	6.8	8.5	6.9	8.4	7.1
12	9.6	7.2	9.4	7.4	9.3	7.5	9.2	7.7
13	10.4	7.8	10.2	8.0	10.1	8.2	10.0	8.4
14	11.2	8.4	11.0	8.6	10.9	8.8	10.7	9.0
15	12.0	9.0	11.8	9.2	11.6	9.4	11.5	9.6
16	12.8	9.6	12.6	9.8	12.4	10.1	12.3	10.2
17	13.6	10.2	13.4	10.5	13.2	10.7	13.0	10.9
18	14.4	10.8	14.2	11.1	13.9	11.3	13.8	11.6
19	15.2	11.4	15.0	11.7	14.7	12.0	14.5	12.2
20	16.0	12.0	15.8	12.3	15.5	12.6	15.3	12.9
21	16.8	12.6	16.5	12.9	16.3	13.2	16.1	13.5
22	17.6	13.2	17.3	13.5	17.1	13.8	16.8	14.1
23	18.4	13.8	18.1	14.1	17.9	14.5	17.6	14.8
24	19.2	14.4	18.9	14.8	18.6	15.1	18.4	15.4
25	20.0	15.0	19.7	15.4	19.4	15.7	19.1	16.1
26	20.8	15.6	20.5	16.0	20.2	16.4	19.9	16.7
27	21.6	16.2	21.3	16.6	21.0	17.0	20.7	17.4
28	22.4	16.8	22.1	17.2	21.8	17.6	21.4	18.0
29	23.2	17.4	22.8	17.8	22.5	18.3	22.2	18.6
30	24.0	18.0	23.6	18.5	23.3	18.9	23.0	19.3
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.
	53 Deg.		52 Deg.		51 Deg.		50 Deg.	

A TRAVERSE TABLE.

199

Dif.	37 Deg.		38 Deg.		39 Deg.		40 Deg.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
31	24.8	18.6	24.4	19.1	24.1	19.5	23.7	19.9
32	25.6	19.3	25.2	19.7	24.9	20.1	24.5	20.6
33	26.4	19.9	26.0	20.3	25.6	20.8	25.3	21.2
34	27.1	20.5	26.8	20.9	26.4	21.4	26.0	21.9
35	27.9	21.1	27.6	21.5	27.2	22.0	26.8	22.5
36	28.7	21.7	28.4	22.2	28.0	22.7	27.6	23.1
37	29.5	22.3	29.2	22.8	28.8	23.3	28.3	23.8
38	30.3	22.9	29.9	23.4	29.5	23.9	29.1	24.4
39	31.1	23.5	30.7	24.0	30.3	24.5	29.9	25.1
40	31.9	24.1	31.5	24.6	31.1	25.2	30.6	25.7
41	32.7	24.7	32.3	25.2	31.9	25.8	31.4	26.4
42	33.5	25.3	33.1	25.9	32.6	26.4	32.2	27.0
43	34.2	25.9	33.9	26.5	33.4	27.1	32.9	27.6
44	35.1	26.5	34.7	27.1	34.2	27.7	33.7	28.3
45	35.9	27.1	35.5	27.7	35.0	28.3	34.5	28.9
46	36.7	27.7	36.2	28.3	35.7	29.0	35.2	29.6
47	37.5	28.3	37.0	28.9	36.5	29.6	36.0	30.2
48	38.3	28.9	37.8	29.5	37.3	30.2	36.8	30.9
49	39.1	29.5	38.6	30.2	38.1	30.8	37.5	31.5
50	39.9	30.1	39.4	30.8	38.9	31.5	38.3	32.1
51	40.7	30.7	40.2	31.4	39.6	32.1	39.1	32.8
52	41.5	31.3	41.0	32.0	40.4	32.7	39.8	33.4
53	42.3	31.9	41.8	32.6	41.2	33.3	40.6	34.1
54	43.1	32.5	42.5	33.2	42.0	34.0	41.4	34.7
55	43.9	33.1	43.3	33.9	42.7	34.6	42.1	35.4
56	44.7	33.7	44.1	34.5	43.5	35.2	42.9	36.0
57	45.5	34.3	44.9	35.1	44.3	35.9	43.7	36.6
58	46.3	34.9	45.7	35.7	45.1	36.5	44.4	37.3
59	47.1	35.5	46.5	36.3	45.8	37.1	45.2	37.9
60	47.9	36.1	47.3	36.9	46.6	37.8	46.0	38.6
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.
	53 Deg.		52 Deg.		51 Deg.		50 Deg.	

A TRAVERSE TABLE.

Diff.	41 Deg.		42 Deg.		43 Deg.		44 Deg.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
1	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
2	1.5	1.3	1.5	1.3	1.5	1.4	1.4	1.4
3	2.3	2.0	2.2	2.0	2.2	2.0	2.2	2.1
4	3.0	2.6	3.0	2.7	2.9	2.7	2.9	2.8
5	3.8	3.3	3.7	3.3	3.7	3.4	3.6	3.5
6	4.5	3.9	4.5	4.0	4.4	4.1	4.3	4.2
7	5.3	4.6	5.2	4.7	5.1	4.8	5.0	4.9
8	6.0	5.2	5.9	5.3	5.8	5.5	5.7	5.6
9	6.8	5.9	6.7	6.0	6.6	6.1	6.5	6.2
10	7.5	6.6	7.4	6.7	7.3	6.8	7.2	6.9
11	8.3	7.2	8.2	7.4	8.0	7.5	7.9	7.6
12	9.1	7.9	8.9	8.0	8.8	8.2	8.6	8.3
13	9.8	8.5	9.7	8.7	9.5	8.9	9.3	9.0
14	10.6	9.1	10.4	9.4	10.2	9.5	10.1	9.7
15	11.3	9.8	11.1	10.0	11.0	10.2	10.8	10.4
16	12.1	10.5	11.9	10.7	11.7	10.9	11.5	11.1
17	12.8	11.1	12.6	11.4	12.4	11.6	12.2	11.8
18	13.6	11.8	13.4	12.0	13.2	12.3	12.9	12.5
19	14.3	12.5	14.1	12.7	13.9	13.0	13.7	13.2
20	15.1	13.1	14.9	13.4	14.6	13.6	14.4	13.9
21	15.8	13.8	15.6	14.0	15.4	14.3	15.1	14.6
22	16.6	14.4	16.3	14.7	16.1	15.0	15.8	15.3
23	17.4	15.1	17.1	15.4	16.8	15.7	16.5	16.0
24	18.1	15.7	17.8	16.1	17.5	16.4	17.3	16.7
25	18.9	16.4	18.6	16.7	18.3	17.1	18.0	17.4
26	19.6	17.1	19.3	17.4	19.0	17.7	18.7	18.1
27	20.4	17.7	20.1	18.1	19.7	18.4	19.4	18.8
28	21.1	18.4	20.8	18.7	20.5	19.1	20.1	19.4
29	21.9	19.0	21.5	19.4	21.2	19.8	20.9	20.1
30	22.6	19.7	22.3	20.1	21.9	20.5	21.6	20.8
	Dep. Lat.		Dep. Lat.		Dep. Lat.		Dep. Lat.	
	49 Deg.		48 Deg.		47 Deg.		46 Deg.	

A TRAVERSE TABLE.

201

Dif.	41 Deg.		42 Deg.		43 Deg.		44 Deg.	
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.
31	23.4	20.3	23.0	20.7	22.6	21.1	22.3	21.5
32	24.1	21.0	23.8	21.4	23.4	21.8	23.0	22.2
33	24.9	21.7	24.5	22.1	24.1	22.5	23.7	22.9
34	25.6	22.3	25.3	22.7	24.9	23.2	24.5	23.6
35	26.4	23.0	26.0	23.4	25.6	23.9	25.2	24.3
36	27.2	23.6	26.7	24.1	26.3	24.5	25.9	25.0
37	27.9	24.3	27.5	24.7	27.0	25.2	26.6	26.7
38	28.7	24.9	28.2	25.4	27.8	25.9	27.3	26.4
39	29.4	25.6	29.0	26.1	28.5	26.6	28.0	27.1
40	30.2	26.2	29.7	26.8	29.2	27.3	28.8	27.8
41	31.0	26.9	30.5	27.4	30.0	28.0	29.5	28.5
42	31.7	27.5	31.2	28.1	30.7	28.6	30.2	29.2
43	32.5	28.2	31.9	28.8	31.4	29.3	30.9	29.9
44	33.2	28.9	32.7	29.4	32.2	30.0	31.6	30.6
45	34.0	29.5	33.4	30.1	32.9	30.7	32.3	31.3
46	34.7	30.2	34.2	30.8	33.6	31.4	33.1	32.0
47	35.5	30.8	34.9	31.4	34.4	32.1	33.8	32.6
48	36.3	31.5	35.7	32.1	35.1	32.7	34.5	33.3
49	37.0	32.1	36.4	32.8	35.8	33.4	35.2	34.0
50	37.7	32.8	37.2	33.5	36.6	34.1	36.0	34.7
51	38.5	33.5	37.9	34.1	37.3	34.8	36.7	35.4
52	39.2	34.1	38.6	34.8	38.0	35.5	37.4	36.1
53	40.0	34.8	39.4	35.5	28.8	36.1	38.1	36.8
54	40.8	35.4	40.1	36.1	39.5	36.8	38.8	37.5
55	41.5	36.0	40.9	36.8	40.2	37.5	39.6	38.2
56	42.3	36.7	41.6	37.5	41.0	38.2	40.3	38.9
57	43.0	37.4	42.4	38.1	41.7	38.9	41.0	39.6
58	43.8	38.1	43.1	38.8	42.4	39.5	41.7	40.3
59	44.5	38.7	43.8	39.5	43.1	40.2	42.4	41.0
60	45.3	39.4	44.6	40.1	43.8	40.9	43.2	41.7
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.
	49 Deg.		48 Deg.		47 Deg.		46 Deg.	

A TRAVERSE TABLE.

Diff.	45 Deg.		Diff.	45 Deg.	
	Lat.	Dep.		Lat.	Dep.
1	0.7	0.7	31	21.9	21.9
2	1.4	1.4	32	22.6	22.6
3	2.1	2.1	33	23.3	23.3
4	2.8	2.8	34	24.0	24.0
5	3.5	3.5	35	24.7	24.7
6	4.2	4.2	36	25.4	25.4
7	4.9	4.9	37	26.1	26.1
8	5.7	5.7	38	26.9	26.9
9	6.4	6.4	39	27.6	27.6
10	7.1	7.1	40	28.3	28.3
11	7.8	7.8	41	29.0	29.0
12	8.5	8.5	42	29.7	29.7
13	9.2	9.2	43	30.4	30.4
14	9.9	9.9	44	31.1	31.1
15	10.6	10.6	45	31.8	31.8
16	11.3	11.3	46	32.5	32.5
17	12.0	12.0	47	33.2	33.2
18	12.7	12.7	48	33.9	33.9
19	13.4	13.4	49	34.6	34.6
20	14.1	14.1	50	35.3	35.3
21	14.8	14.8	51	36.1	36.1
22	15.5	15.5	52	36.8	36.8
23	16.3	16.3	53	37.5	37.5
24	17.0	17.0	54	38.2	38.2
25	17.7	17.7	55	38.9	38.9
26	18.4	18.4	56	39.6	39.6
27	19.1	19.1	57	40.3	40.3
28	19.8	19.8	58	41.0	41.0
29	20.5	20.5	59	41.7	41.7
30	21.2	21.2	60	42.4	42.4
Dep. Lat.			Dep. Lat.		
45 Deg.			45 Deg.		

A T A B L E O F M E R I D I O N A L P A R T S.

*To find the Meridional Parts for any Latitude; and
the contrary.*

R U L E.

Seek the Degrees at the Head of the Table; and the Minutes on the left Hand Side. And in the Angle of Meeting you have the meridional Parts required.

E X A M P L E.

To find the M. P. for $42^{\circ} 38'$. In the Column 42, and over-against 38, is 2833, the meridional Parts of $42^{\circ} 38'$.

Again, to find the M. P. for $73^{\circ} 25'$. In the Column 73, and over-against 24, 26, you have 6617, 6624; and the Mean is 6620, the Merid. Parts sought.

And if the M. P. be given, to find the Degrees and Minutes answering. Find the nearest Number in the Table, and you have the Degrees at Top, and the Minutes on the Side of the Table.

Thus the M. P. being 2833, the Degrees and Minutes answering is $42^{\circ} 38'$. And if the M. P. be 6620, the Degrees belonging thereto will be found $73^{\circ} 25'$.

A TABLE of Meridional Parts.

Min.	Degrees of Latitude.							
	0	1	2	3	4	5	6	7
0		60	120	180	240	300	361	421
2	2	62	122	182	242	302	363	423
4	4	64	124	184	244	304	365	425
6	6	66	126	186	246	306	367	427
8	8	68	128	188	248	308	369	429
10	10	70	130	190	250	310	371	431
12	12	72	132	192	252	312	373	433
14	14	74	134	194	254	314	375	435
16	16	76	136	196	256	316	377	437
18	18	78	138	198	258	318	379	439
20	20	80	140	200	260	320	381	441
22	22	82	142	202	262	322	383	443
24	24	84	144	204	264	324	385	445
26	26	86	146	206	266	326	387	447
28	28	88	148	208	268	328	389	449
30	30	90	150	210	270	330	391	451
32	32	92	152	212	272	332	393	453
34	34	94	154	214	274	334	395	455
36	36	96	156	216	276	336	397	457
38	38	98	158	218	278	338	399	459
40	40	100	160	220	280	340	401	461
42	42	102	162	222	282	342	403	463
44	44	104	164	224	284	344	405	465
46	46	106	166	226	286	346	407	467
48	48	108	168	228	288	348	409	469
50	50	110	170	230	290	350	411	471
52	52	112	172	232	292	352	413	473
54	54	114	174	234	294	354	415	475
56	56	116	176	236	296	356	417	477
58	58	118	178	238	298	358	419	479
60	60	120	180	240	300	361	421	481

A TABLE of Meridional Parts.

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Min.	Degrees of Latitude.						
	8	9	10	11	12	13	14
0	481	542	603	664	725	787	848
2	483	544	605	666	727	789	850
4	485	546	607	668	729	791	852
6	488	548	609	670	731	793	855
8	490	550	611	672	733	795	857
10	492	552	613	674	735	797	859
12	494	554	615	676	737	799	861
14	496	556	617	678	740	801	863
16	498	558	619	680	742	803	865
18	500	560	621	682	744	805	867
20	502	562	623	684	746	807	869
22	504	564	625	686	748	809	871
24	506	566	627	688	750	811	873
26	508	568	629	690	752	813	875
28	510	570	631	692	754	815	877
30	512	573	633	695	756	817	879
32	514	575	635	697	758	820	881
34	516	577	638	699	760	822	883
36	518	579	640	701	762	824	886
38	520	581	642	703	764	826	888
40	522	583	644	705	766	828	890
42	524	585	646	707	768	830	892
44	526	587	648	709	770	832	894
46	528	589	650	711	772	834	896
48	530	591	652	713	774	836	898
50	532	593	654	715	776	838	900
52	534	595	656	717	778	840	902
54	536	597	658	719	781	842	904
56	538	599	660	721	783	844	906
58	540	601	662	723	785	846	908
60	542	603	664	725	787	848	910

A TABLE of Meridional Parts.

Min.	Degrees of Latitude.						
	15	16	17	18	19	20	21
0	910	973	1035	1098	1161	1225	1289
2	912	975	1037	1100	1163	1227	1291
4	914	977	1039	1102	1166	1229	1293
6	917	979	1041	1104	1168	1231	1296
8	919	981	1044	1107	1170	1234	1298
10	921	983	1046	1109	1172	1236	1300
12	923	985	1048	1111	1174	1238	1302
14	925	987	1050	1113	1176	1240	1304
16	927	989	1052	1115	1178	1242	1306
18	929	991	1054	1117	1180	1244	1308
20	931	993	1056	1119	1183	1246	1311
22	933	996	1058	1121	1185	1248	1313
24	935	998	1060	1123	1187	1251	1315
26	937	1000	1062	1125	1189	1253	1317
28	939	1002	1064	1128	1191	1255	1319
30	941	1004	1067	1130	1193	1257	1321
32	944	1006	1069	1132	1195	1259	1323
34	946	1008	1071	1134	1197	1261	1326
36	948	1010	1073	1136	1200	1263	1328
38	950	1012	1075	1138	1202	1266	1330
40	952	1014	1077	1140	1204	1268	1332
42	954	1016	1079	1142	1206	1270	1334
44	956	1018	1081	1144	1208	1272	1336
46	958	1021	1083	1147	1210	1274	1338
48	960	1023	1085	1149	1212	1276	1341
50	962	1025	1088	1151	1214	1278	1343
52	964	1027	1090	1153	1216	1281	1345
54	966	1029	1092	1155	1219	1283	1347
56	968	1031	1094	1157	1221	1285	1349
58	971	1033	1096	1159	1223	1287	1351
60	973	1035	1098	1161	1225	1289	1354

Min.	Degrees of Latitude.						
	22	23	24	25	26	27	28
0	1354	1419	1484	1550	1616	1684	1751
2	1356	1421	1486	1552	1619	1686	1753
4	1358	1423	1488	1554	1621	1688	1756
6	1360	1425	1491	1557	1623	1690	1758
8	1362	1427	1493	1559	1625	1692	1760
10	1364	1429	1495	1561	1628	1695	1762
12	1367	1431	1497	1563	1630	1697	1765
14	1369	1434	1499	1565	1632	1699	1767
16	1371	1436	1501	1568	1634	1701	1769
18	1373	1438	1504	1570	1636	1704	1771
20	1375	1440	1506	1572	1639	1706	1774
22	1377	1442	1508	1574	1641	1708	1776
24	1379	1445	1510	1576	1643	1710	1778
26	1382	1447	1512	1579	1645	1713	1781
28	1384	1449	1515	1581	1648	1715	1783
30	1386	1451	1517	1583	1650	1717	1785
32	1388	1453	1519	1585	1652	1719	1787
34	1390	1456	1521	1587	1654	1722	1790
36	1392	1458	1523	1590	1657	1724	1792
38	1395	1460	1526	1592	1659	1726	1794
40	1397	1462	1528	1594	1661	1728	1797
42	1399	1464	1530	1596	1663	1731	1799
44	1401	1466	1532	1599	1665	1733	1801
46	1403	1469	1534	1601	1668	1735	1803
48	1405	1471	1537	1603	1670	1737	1806
50	1408	1473	1539	1605	1672	1740	1808
52	1410	1475	1541	1607	1674	1742	1810
54	1412	1477	1543	1610	1677	1744	1812
56	1414	1480	1545	1612	1679	1747	1815
58	1416	1482	1548	1614	1681	1749	1817
60	1419	1484	1550	1616	1684	1751	1819

A TABLE of Meridional Parts,

Min.	Degrees of Latitude.						
	29	30	31	32	33	34	35
0	1819	1888	1958	2028	2100	2171	2244
2	1822	1891	1960	2031	2102	2174	2247
4	1824	1893	1963	2033	2104	2176	2249
6	1826	1895	1965	2035	2107	2179	2252
8	1828	1898	1967	2038	2109	2181	2254
10	1831	1900	1970	2040	2111	2183	2256
12	1833	1902	1972	2042	2114	2186	2259
14	1835	1904	1974	2045	2116	2188	2261
16	1838	1907	1977	2047	2119	2191	2264
18	1840	1909	1979	2050	2121	2193	2266
20	1842	1911	1981	2052	2123	2196	2269
22	1845	1914	1984	2054	2126	2198	2271
24	1847	1916	1986	2057	2128	2200	2274
26	1849	1918	1988	2059	2131	2203	2276
28	1851	1921	1991	2061	2133	2205	2278
30	1854	1923	1993	2064	2135	2208	2281
32	1856	1925	1995	2066	2138	2210	2283
34	1858	1928	1998	2069	2140	2213	2286
36	1861	1930	2000	2071	2143	2215	2288
38	1863	1932	2002	2073	2145	2217	2291
40	1865	1935	2005	2076	2147	2220	2293
42	1868	1937	2007	2078	2150	2222	2296
44	1870	1939	2009	2080	2152	2225	2298
46	1872	1942	2012	2083	2155	2227	2301
48	1874	1944	2014	2085	2157	2230	2303
50	1877	1946	2017	2088	2159	2232	2306
52	1879	1948	2019	2090	2162	2234	2308
54	1881	1951	2021	2092	2164	2237	2311
56	1884	1953	2024	2095	2167	2239	2313
58	1886	1956	2026	2097	2169	2242	2315
60	1888	1958	2028	2100	2171	2244	2318

A TABLE of Meridional Parts.

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Min.	Degrees of Latitude.						
	36	37	38	39	40	41	42
0	2318	2393	2468	2545	2622	2702	2782
2	2320	2395	2471	2547	2625	2704	2784
4	2323	2398	2473	2550	2628	2707	2787
6	2325	2400	2476	2553	2630	2710	2790
8	2328	2403	2478	2555	2633	2712	2792
10	2330	2405	2481	2558	2636	2715	2795
12	2333	2408	2483	2560	2638	2717	2798
14	2335	2410	2486	2563	2641	2720	2801
16	2338	2413	2489	2566	2644	2723	2803
18	2340	2415	2491	2568	2646	2725	2806
20	2343	2418	2494	2571	2649	2728	2809
22	2345	2420	2496	2573	2651	2731	2811
24	2348	2423	2499	2575	2654	2733	2814
26	2350	2425	2501	2578	2657	2736	2817
28	2353	2428	2504	2581	2659	2739	2820
30	2355	2430	2506	2584	2662	2741	2822
32	2358	2433	2509	2586	2665	2744	2825
34	2360	2435	2512	2589	2667	2747	2828
36	2363	2438	2514	2591	2670	2749	2830
38	2365	2440	2517	2594	2673	2752	2833
40	2368	2443	2519	2597	2675	2755	2836
42	2370	2445	2522	2599	2678	2758	2839
44	2373	2448	2524	2602	2680	2760	2841
46	2375	2450	2527	2604	2683	2763	2844
48	2378	2453	2529	2607	2686	2766	2847
50	2380	2456	2532	2610	2688	2768	2849
52	2383	2458	2535	2612	2691	2771	2852
54	2385	2461	2537	2615	2694	2774	2855
56	2388	2463	2540	2617	2696	2776	2858
58	2390	2466	2542	2620	2699	2779	2860
60	2393	2468	2545	2622	2702	2782	2863

A TABLE of Meridional Parts.

Min.	Degrees of Latitude.						
	43	44	45	46	47	48	49
0	2863	2946	3030	3116	3203	3292	3382
2	2866	2949	3033	3118	3206	3295	3385
4	2869	2951	3036	3121	3209	3298	3388
6	2871	2953	3038	3124	3212	3301	3391
8	2874	2956	3041	3127	3214	3304	3394
10	2877	2959	3044	3130	3217	3307	3397
12	2880	2962	3047	3133	3220	3310	3400
14	2882	2965	3050	3136	3223	3313	3403
16	2885	2968	3053	3139	3226	3316	3407
18	2888	2971	3055	3142	3229	3319	3410
20	2890	2974	3058	3144	3232	3322	3413
22	2893	2976	3061	3147	3235	3325	3416
24	2896	2979	3064	3150	3238	3328	3419
26	2899	2982	3067	3153	3241	3331	3422
28	2902	2985	3070	3156	3244	3334	3425
30	2904	2988	3073	3159	3247	3337	3428
32	2907	2990	3075	3162	3250	3340	3431
34	2910	2993	3078	3165	3253	3343	3434
36	2913	2996	3081	3168	3256	3346	3437
38	2915	2999	3084	3171	3259	3349	3440
40	2918	3002	3087	3173	3262	3352	3443
42	2921	3005	3090	3176	3265	3355	3446
44	2924	3007	3093	3179	3268	3358	3449
46	2926	3010	3095	3182	3271	3361	3453
48	2929	3013	3098	3185	3274	3364	3456
50	2932	3016	3101	3188	3277	3367	3459
52	2935	3019	3104	3191	3280	3370	3462
54	2937	3022	3107	3194	3283	3373	3465
56	2940	3024	3110	3197	3286	3376	3468
58	2943	3027	3113	3200	3289	3379	3471
60	2946	3030	3116	3203	3292	3382	3475

A TABLE of Meridional Parts.

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Min.	Degrees of Latitude.						
	50	51	52	53	54	55	56
0	3475	3569	3665	3764	3865	3968	4074
2	3478	3572	3669	3768	3868	3972	4078
4	3481	3575	3672	3771	3872	3975	4081
6	3484	3578	3675	3774	3875	3979	4085
8	3487	3582	3678	3777	3878	3982	4088
10	3490	3585	3682	3780	3882	3986	4092
12	3493	3588	3685	3784	3885	3989	4096
14	3496	3591	3688	3787	3889	3993	4100
16	3499	3594	3691	3791	3892	3996	4103
18	3503	3597	3695	3794	3895	4000	4106
20	3506	3600	3698	3797	3899	4003	4110
22	3509	3604	3701	3801	3902	4007	4114
24	3512	3607	3705	3804	3906	4010	4117
26	3515	3610	3708	3807	3909	4014	4121
28	3518	3614	3711	3811	3913	4017	4124
30	3521	3617	3714	3814	3916	4021	4128
32	3525	3620	3718	3817	3920	4024	4132
34	3528	3623	3721	3821	3923	4028	4135
36	3531	3626	3724	3824	3926	4031	4139
38	3534	3630	3728	3827	3930	4035	4143
40	3537	3633	3731	3831	3933	4038	4146
42	3540	3636	3734	3834	3937	4042	4150
44	3543	3639	3737	3838	3940	4046	4154
46	3547	3643	3741	3841	3944	4049	4157
48	3550	3646	3744	3844	3947	4053	4161
50	3553	3649	3747	3848	3951	4056	4164
52	3556	3652	3751	3851	3954	4060	4168
54	3559	3656	3754	3855	3958	4063	4172
56	3562	3659	3757	3858	3961	4067	4175
58	3566	3662	3761	3861	3965	4070	4179
60	3569	3665	3764	3865	3968	4074	4183

A TABLE of Meridional Parts.

Min.	Degrees of Latitude.						
	57	58	59	60	61	62	63
0	4183	4294	4409	4527	4649	4775	4905
2	4187	4298	4413	4531	4654	4780	4910
4	4190	4302	4417	4535	4658	4784	4914
6	4194	4306	4421	4539	4662	4788	4919
8	4197	4310	4425	4543	4666	4792	4923
10	4201	4313	4429	4547	4670	4797	4927
12	4205	4317	4433	4551	4674	4801	4932
14	4209	4321	4437	4555	4678	4805	4936
16	4212	4325	4441	4559	4683	4810	4941
18	4216	4329	4444	4564	4687	4814	4945
20	4220	4332	4448	4568	4691	4818	4950
22	4223	4336	4452	4572	4695	4822	4954
24	4227	4340	4456	4576	4699	4827	4959
26	4231	4344	4460	4580	4704	4831	4963
28	4235	4348	4464	4584	4708	4835	4967
30	4238	4352	4468	4588	4712	4840	4972
32	4242	4355	4472	4592	4716	4844	4976
34	4246	4359	4476	4596	4720	4848	4981
36	4249	4363	4480	4600	4724	4853	4985
38	4253	4367	4484	4604	4729	4857	4990
40	4257	4371	4488	4608	4733	4861	4994
42	4261	4375	4492	4613	4737	4866	4999
44	4264	4378	4496	4617	4741	4870	5003
46	4268	4382	4500	4621	4746	4875	5008
48	4272	4386	4504	4625	4750	4879	5012
50	4276	4390	4508	4629	4754	4883	5017
52	4279	4394	4512	4633	4758	4888	5022
54	4283	4398	4516	4637	4763	4892	5026
56	4287	4402	4520	4641	4767	4896	5031
58	4291	4405	4523	4645	4771	4901	5035
60	4294	4409	4527	4649	4775	4905	5040

Min.	Degrees of Latitude.						
	64	65	66	67	68	69	70
0	5040	5179	5324	5474	5631	5795	5966
2	5044	5184	5329	5480	5637	5801	5971
4	5049	5189	5334	5485	5642	5806	5977
6	5053	5193	5339	5490	5647	5812	5983
8	5058	5198	5344	5495	5653	5818	5989
10	5063	5203	5349	5500	5658	5823	5995
12	5067	5208	5354	5505	5664	5829	6001
14	5072	5212	5359	5511	5669	5834	6007
16	5076	5217	5364	5516	5674	5840	6013
18	5081	5222	5368	5521	5680	5846	6019
20	5086	5227	5373	5526	5685	5851	6025
22	5090	5232	5378	5531	5691	5857	6031
24	5095	5236	5383	5537	5696	5863	6037
26	5100	5241	5388	5542	5701	5868	6042
28	5104	5246	5393	5547	5707	5874	6048
30	5109	5251	5398	5552	5712	5880	6054
32	5114	5256	5403	5557	5718	5886	6060
34	5118	5261	5409	5563	5723	5891	6066
36	5123	5265	5414	5568	5729	5897	6072
38	5127	5270	5419	5573	5734	5903	6078
40	5132	5275	5424	5578	5740	5909	6084
42	5137	5280	5429	5584	5745	5914	6091
44	5142	5285	5434	5589	5751	5919	6097
46	5146	5290	5439	5594	5756	5925	6103
48	5151	5295	5444	5599	5762	5931	6109
50	5156	5299	5449	5605	5767	5936	6115
52	5160	5304	5454	5610	5773	5942	6121
54	5165	5309	5459	5615	5778	5948	6127
56	5170	5314	5464	5621	5784	5954	6133
58	5174	5319	5469	5626	5790	5960	6139
60	5179	5324	5474	5631	5795	5966	6146

A TABLE of Meridional Parts.

Min.	Degrees of Latitude.						
	71	72	73	74	75	76	77
0	6146	6335	6534	6746	6970	7210	7467
2	6152	6341	6541	6753	6978	7218	7476
4	6158	6348	6548	6760	6986	7227	7484
6	6164	6354	6555	6768	6994	7235	7493
8	6170	6361	6562	6775	7002	7244	7502
10	6176	6367	6569	6782	7010	7252	7511
12	6182	6374	6576	6790	7018	7261	7520
14	6189	6380	6583	6797	7026	7269	7529
16	6195	6387	6589	6804	7034	7278	7538
18	6201	6393	6596	6812	7042	7286	7548
20	6207	6400	6603	6819	7050	7295	7557
22	6214	6407	6610	6826	7058	7304	7566
24	6220	6413	6617	6834	7066	7312	7575
26	6226	6420	6624	6841	7074	7321	7584
28	6233	6426	6631	6849	7082	7329	7594
30	6239	6433	6638	6856	7090	7338	7604
32	6245	6440	6646	6864	7098	7347	7613
34	6251	6446	6653	6871	7106	7355	7622
36	6258	6453	6660	6879	7114	7364	7631
38	6264	6460	6667	6886	7122	7372	7641
40	6270	6467	6674	6894	7130	7381	7650
42	6277	6473	6681	6902	7138	7390	7660
44	6283	6480	6688	6909	7146	7398	7669
46	6290	6487	6695	6917	7154	7407	7678
48	6296	6493	6702	6924	7162	7415	7688
50	6302	6500	6710	6932	7170	7424	7697
52	6309	6507	6717	6940	7178	7433	7707
54	6315	6514	6724	6947	7186	7441	7716
56	6322	6521	6731	6955	7194	7450	7726
58	6328	6527	6738	6963	7202	7458	7736
60	6335	6534	6746	6970	7210	7467	7745

Min.	Degrees of Latitude.					
	78	79	80	81	82	83
0	7745	8046	8375	8739	9146	9606
2	7755	8057	8386	8752	9161	9622
4	7764	8068	8398	8765	9175	9639
6	7774	8078	8410	8778	9190	9656
8	7784	8089	8422	8791	9204	9672
10	7794	8099	8433	8804	9219	9689
12	7803	8110	8445	8817	9234	9706
14	7813	8121	8457	8830	9248	9723
16	7823	8131	8469	8843	9263	9740
18	7833	8142	8481	8857	9278	9757
20	7843	8153	8492	8870	9293	9774
22	7853	8164	8504	8883	9308	9792
24	7863	8175	8516	8896	9323	9809
26	7873	8186	8528	8910	9338	9827
28	7883	8196	8540	8923	9353	9844
30	7893	8206	8553	8937	9368	9862
32	7903	8217	8565	8950	9383	9879
34	7913	8229	8577	8964	9399	9897
36	7923	8240	8589	8978	9414	9915
38	7933	8251	8601	8991	9430	9933
40	7943	8262	8614	9005	9446	9951
42	7953	8273	8626	9019	9461	9970
44	7964	8284	8639	9033	9477	9989
46	7974	8295	8651	9047	9493	10006
48	7984	8307	8663	9061	9509	10025
50	7994	8318	8676	9075	9525	10043
52	8005	8329	8689	9089	9541	10061
54	8015	8341	8701	9103	9557	10080
56	8026	8352	8714	9118	9573	10099
58	8036	8364	8727	9132	9590	10118
60	8046	8375	8739	9146	9606	10137

A TABLE of Meridional Parts.

Min.	Degrees of Latitude.					
	84	85	86	87	88	89
0	10137	10765	11533	12522	13916	16300
2	10156	10788	11562	12560	13974	16416
4	10175	10811	11591	12599	14033	16537
6	10194	10834	11620	12639	14093	16661
8	10214	10858	11650	12679	14154	16792
10	10234	10881	11680	12719	14216	16926
12	10254	10905	11710	12760	14279	17067
14	10274	10929	11740	12801	14343	17213
16	10294	10953	11770	12842	14408	17366
18	10314	10978	11801	12884	14475	17526
20	10334	11002	11832	12927	14543	17693
22	10354	11027	11863	12970	14612	17870
24	10374	11052	11895	13014	14683	18056
26	10395	11077	11927	13059	14756	18252
28	10416	11102	11960	13104	14830	18461
30	10437	11127	11992	13150	14906	18682
32	10457	11152	12025	13196	14983	18920
34	10478	11178	12059	13243	15062	19174
36	10499	11204	12092	13290	15143	19450
38	10521	11230	12126	13338	15226	19749
40	10542	11257	12160	13386	15311	20076
42	10564	11283	12194	13435	15398	20439
44	10585	11310	12229	13485	15487	20843
46	10607	11337	12265	13536	15579	21303
48	10629	11365	12300	13588	15673	21832
50	10651	11392	12336	13641	15770	22459
52	10674	11420	12372	13694	15870	23226
54	10696	11448	12408	13748	15973	24215
56	10719	11476	12445	13803	16079	25609
58	10742	11504	12483	13859	16188	27992
60	10765	11533	12522	13916	16300	infinite.

A T A B L E

O F

Logarithmic Sines, Cofines, Tangents and Cotangents.

*To find the Sine, Tangent, &c. of any Number of
Degrees and Minutes.*

R U L E.

Find the Degrees at Top of the Table, the Minutes on the left Hand; against which, under the Title *Sine, Tang. &c.* is the Sine, Tangent required.

Or, if the Degrees exceed 45° , find them at the Bottom; and, against the Minutes on the right Hand, above the Words *Sine, Tang. &c.* you have the Sine or Tangent sought.

Note, If the Degrees exceed 90, subtract them from 180, and take the Remainder. Or rather find the Degrees at Top or Bottom, and the Minutes under or above, on the same Side.

E X A M P L E.

The Sine of 17 deg. 23 min. is 9.47532; and the Cofine 9.97969. The Tan. of 125 deg. 47 min. or of 54 deg. 13 min. is 10.14219, and Cotan. 9.85780.

And if the Sine or Tangent, &c. be given, the Degrees answering to it may be found, by seeking the given Sine or Tangent in its proper Column. Thus, if the Cofine be 9.76271, the Number of Degrees answering is 54 deg. 37 min.

When you cannot find it exactly, take the nearest. Thus, if the Tangent be 10.66735, the nearest is 10.66758, whose N. of Degrees is 77 deg. 52 min.

L

Min.	0 Degrees.				179
	Sine.	Cofine.	Tangent.	Cotang.	
0	0	10.	0	Infinite.	60
1	6.46372	9.99999	6.46372	13.53627	59
2	6.76475	9.99999	6.76475	13.23524	58
3	6.94084	9.99999	6.94084	13.05915	56
4	7.06578	9.99999	7.06578	12.93421	56
5	7.16269	9.99999	7.16269	12.83730	55
6	7.24187	9.99999	7.24187	12.75812	54
7	7.30882	9.99999	7.30882	12.69117	53
8	7.36681	9.99999	7.36681	12.63318	52
9	7.41796	9.99999	7.41796	12.58203	51
10	7.46372	9.99999	7.46372	12.53627	50
11	7.50511	9.99999	7.50512	12.49487	49
12	7.54290	9.99999	7.54290	12.45709	48
13	7.57766	9.99999	7.57767	12.42232	47
14	7.60985	9.99999	7.60985	12.39014	46
15	7.63981	9.99999	7.63982	12.36017	45
16	7.66784	9.99999	7.66784	12.33215	44
17	7.69417	9.99999	7.69417	12.30582	43
18	7.71899	9.99999	7.71900	12.28099	42
19	7.74247	9.99999	7.74248	12.25751	41
20	7.76475	9.99999	7.76476	12.23523	40
21	7.78594	9.99999	7.78595	12.21404	39
22	7.80614	9.99999	7.80615	12.19384	38
23	7.82545	9.99999	7.82546	12.17453	37
24	7.84393	9.99998	7.84394	12.15605	36
25	7.86166	9.96998	7.86167	12.13832	35
26	7.87809	9.99998	7.87870	12.12129	34
27	7.89508	9.99998	7.895 9	12.10490	33
28	7.91087	9.99998	7.91089	12.08919	32
29	7.92611	9.99998	7.92613	12.07386	31
30	7.94084	9.99998	7.94085	12.05914	30
	Cofine.	Sine.	Cotang.	Tangent	Σ
90					89 Degrees.

Min.	0 Degrees.				179
	Sine.	Cofine.	Tangent.	Cotang.	
30	7.94084	9.99998	7.94085	12.05914	30
31	7.95508	9.99998	7.95509	12.04490	29
32	7.96886	9.99998	7.96888	12.03111	28
33	7.98223	9.99998	7.98225	12.01774	27
34	7.99519	9.99997	7.99521	12.00478	26
35	8.00778	9.99997	8.00781	11.99219	25
36	8.02002	9.99997	8.02004	11.97995	24
37	8.03191	9.99997	8.03194	11.96805	23
38	8.04350	9.99997	8.04352	11.95647	22
39	8.05478	9.99997	8.05480	11.94519	21
40	8.06577	9.99997	8.06580	11.93419	20
41	8.07649	9.99996	8.07653	11.92346	19
42	8.08696	9.99996	8.08699	11.91300	18
43	8.09718	9.99996	8.09721	11.90278	17
44	8.10716	9.99996	8.10720	11.89279	16
45	8.11692	9.99996	8.11696	11.88303	15
46	8.12647	9.99996	8.12050	11.87349	14
47	8.13581	9.99995	8.13585	11.86414	13
48	8.14495	9.99995	8.14499	11.85500	12
49	8.15390	9.99995	8.15395	11.84604	11
50	8.16268	9.99995	8.16272	11.83727	10
51	8.17128	9.99995	8.17132	11.82867	9
52	8.17971	9.99995	8.17976	11.82023	8
53	8.18798	9.99994	8.18803	11.81196	7
54	8.19610	9.99994	8.19615	11.80384	6
55	8.20407	9.99994	8.20412	11.79587	5
56	8.21189	9.99994	8.21195	11.78804	4
57	8.21958	9.99994	8.21964	11.78035	3
58	8.22713	9.99993	8.22719	11.77280	2
59	8.23455	9.99993	8.23462	11.76537	1
60	8.24185	9.99993	8.24192	11.75807	0
	Cofine.	Sine.	Cotang.	Tangent.	Σ
90					89 Degrees.

Min.	1 Degree.				178
	Sine.	Cofine.	Tangent.	Cotang.	
0	8.24185	9.99993	8.24192	11.75807	60
1	8.24903	9.99993	8.24910	11.75089	59
2	8.25609	9.99992	8.25616	11.74383	58
3	8.26304	9.99992	8.26311	11.73688	57
4	8.26988	9.99992	8.26995	11.73004	56
5	8.27661	9.99992	8.27669	11.72330	55
6	8.28324	9.99992	8.28332	11.71667	54
7	8.28977	9.99991	8.28985	11.71014	53
8	8.29620	9.99991	8.29629	11.70370	52
9	8.30254	9.99991	8.30263	11.69736	51
10	8.30879	9.99991	8.30888	11.69111	50
11	8.31495	9.99990	8.31504	11.68495	49
12	8.32102	9.99990	8.32112	11.67887	48
13	8.32701	9.99990	8.32711	11.67288	47
14	8.33292	9.99989	8.33302	11.66697	46
15	8.33875	9.99989	8.33885	11.66114	45
16	8.34450	9.99989	8.34461	11.65538	44
17	8.35018	9.99989	8.35028	11.64971	43
18	8.35578	9.99988	8.35589	11.64410	42
19	8.36131	9.99988	8.36142	11.63857	41
20	8.36677	9.99988	8.36689	11.63310	40
21	8.37217	9.99987	8.37229	11.62770	39
22	8.37749	9.99987	8.37762	11.62237	38
23	8.38276	9.99987	8.38288	11.61711	37
24	8.38796	9.99987	8.38809	11.61190	36
25	8.39310	9.99986	8.39323	11.60676	35
26	8.39817	9.99986	8.39831	11.60168	34
27	8.40319	9.99986	8.40333	11.59666	33
28	8.40816	9.99985	8.40830	11.59169	32
29	8.41306	9.99985	8.41321	11.58678	31
30	8.41791	9.99985	8.41806	11.58193	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
91					88 Degrees,

Min.	1 Degree.				178
	Sine.	Cofine.	Tangent.	Cotang.	
30	8.41791	9.99985	8.41806	11.58193	30
31	8.42271	9.99984	8.42286	11.57713	29
32	8.42746	9.99984	8.42761	11.57238	28
33	8.43215	9.99984	8.43231	11.56768	27
34	8.43679	9.99983	8.43696	11.56303	26
35	8.44139	9.99983	8.44156	11.55843	25
36	8.44594	9.99983	8.44611	11.55388	24
37	8.45044	9.99982	8.45061	11.54938	23
38	8.45489	9.99982	8.45506	11.54493	22
39	8.45930	9.99981	8.45948	11.54051	21
40	8.46366	9.99981	8.46384	11.53615	20
41	8.46798	9.99981	8.46817	11.53182	19
42	8.47226	9.99980	8.47245	11.52754	18
43	8.47649	9.99980	8.47669	11.52330	17
44	8.48069	9.99980	8.48089	11.51910	16
45	8.48484	9.99979	8.48505	11.51494	15
46	8.48896	9.99979	8.48916	11.51083	14
47	8.49303	9.99978	8.49325	11.50674	13
48	8.49707	9.99978	8.49729	11.50270	12
49	8.50107	9.99978	8.50129	11.49870	11
50	8.50504	9.99977	8.50526	11.49473	10
51	8.50897	9.99977	8.50920	11.49079	9
52	8.51286	9.99976	8.51309	11.48690	8
53	8.51672	9.99976	8.51696	11.48303	7
54	8.52055	9.99976	8.52079	11.47920	6
55	8.52434	9.99975	8.52458	11.47541	5
56	8.52810	9.99975	8.52834	11.47165	4
57	8.53182	9.99974	8.53207	11.46792	3
58	8.53552	9.99974	8.53577	11.46422	2
59	8.53918	9.99973	8.53944	11.46055	1
60	8.54281	9.99973	8.54308	11.45691	0
	Cofine.	Sine.	Cotang.	Tangent.	Σ
91					88 Degrees.

Min.	2 Degrees.				177
	Sine.	Cofine	Tangent.	Cotang.	
0	8.54281	9.99973	8.54308	11.45691	60
1	8.54642	9.99973	8.54669	11.45330	59
2	8.54999	9.99972	8.55026	11.44973	58
3	8.55353	9.99972	8.55381	11.44618	57
4	8.55705	9.99971	8.55733	11.44266	56
5	8.56054	9.99971	8.56082	11.43917	55
6	8.56399	9.99970	8.56429	11.43570	54
7	8.56743	9.99970	8.56772	11.43227	53
8	8.57083	9.99969	8.57113	11.42886	52
9	8.57421	9.99969	8.57451	11.42548	51
10	8.57756	9.99968	8.57787	11.42212	50
11	8.58089	9.99968	8.58120	11.41879	49
12	8.58419	9.99967	8.58451	11.41548	48
13	8.58746	9.99967	8.58779	11.41220	47
14	8.59072	9.99967	8.59105	11.40894	46
15	8.59394	9.99966	8.59428	11.40571	45
16	8.59715	9.99966	8.59749	11.40250	44
17	8.60033	9.99965	8.60067	11.39932	43
18	8.60348	9.99965	8.60383	11.39616	42
19	8.60662	9.99964	8.60697	11.39302	41
20	8.60973	9.99963	8.61009	11.38990	40
21	8.61282	9.99963	8.61318	11.38681	39
22	8.61589	9.99962	8.61626	11.38373	38
23	8.61893	9.99962	8.61931	11.38068	37
24	8.62196	9.99961	8.62234	11.37765	36
25	8.62496	9.99961	8.62535	11.37464	35
26	8.62794	9.99960	8.62834	11.37165	34
27	8.63091	9.99960	8.63130	11.36869	33
28	8.63385	9.99959	8.63425	11.36574	32
29	8.63677	9.99959	8.63718	11.36281	31
30	8.63967	9.99958	8.64009	11.35990	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
92					87 Degrees.

Min.	2 Degrees.				177
	Sine.	Cofine.	Tangent.	Cotang.	
30	8.63967	9.99958	8.64009	11.35990	30
31	8.64256	9.99958	8.64298	11.35701	29
32	8.64542	9.99957	8.64585	11.35414	28
33	8.64827	9.99956	8.64870	11.35129	27
34	8.65110	9.99956	8.65153	11.34846	26
35	8.65391	9.99955	8.65435	11.34564	25
36	8.65670	9.99955	8.65714	11.34285	24
37	8.65947	9.99954	8.65992	11.34007	23
38	8.66223	9.99954	8.66268	11.33731	22
39	8.66496	9.99953	8.66543	11.33456	21
40	8.66768	9.99952	8.66815	11.33184	20
41	8.67039	9.99952	8.67086	11.32913	19
42	8.67308	9.99951	8.67356	11.32643	18
43	8.67575	9.99951	8.67623	11.32376	17
44	8.67840	9.99950	8.67889	11.32110	16
45	8.68104	9.99949	8.68154	11.31845	15
46	8.68366	9.99949	8.68417	11.31582	14
47	8.68627	9.99948	8.68678	11.31321	13
48	8.68886	9.99948	8.68938	11.31061	12
49	8.69143	9.99947	8.69196	11.30803	11
50	8.69399	9.99946	8.69452	11.30547	10
51	8.69654	9.99946	8.69708	11.30291	9
52	8.69907	9.99945	8.69961	11.30038	8
53	8.70158	9.99944	8.70213	11.29786	7
54	8.70408	9.99944	8.70464	11.29535	6
55	8.70657	9.99943	8.70713	11.29286	5
56	8.70904	9.99943	8.70961	11.29038	4
57	8.71150	9.99942	8.71208	11.28791	3
58	8.71395	9.99941	8.71453	11.28546	2
59	8.71638	9.99941	8.71697	11.28302	1
60	8.71880	9.99940	8.71939	11.28060	0
	Cofine.	Sine.	Cotang	Tan-e-t.	Σ
92					87 Degrees.

Min.	3 Degrees.				176
	Sine.	Cofine.	Tangent.	Cotang.	
0	8.71880	9.99940	8.71939	11.28060	60
1	8.72120	9.99939	8.72180	11.27819	59
2	8.72359	9.99939	8.72420	11.27579	58
3	8.72597	9.99938	8.72658	11.27341	57
4	8.72833	9.99937	8.72895	11.27104	56
5	8.73068	9.99937	8.73131	11.26868	55
6	8.73302	9.99936	8.73366	11.26633	54
7	8.73535	9.99935	8.73599	11.26400	53
8	8.73766	9.99935	8.73831	11.26168	52
9	8.73996	9.99934	8.74062	11.25937	51
10	8.74225	9.99933	8.74292	11.25707	50
11	8.74453	9.99932	8.74520	11.25479	49
12	8.74680	9.99932	8.74747	11.25252	48
13	8.74905	9.99931	8.74974	11.25026	47
14	8.75129	9.99930	8.75198	11.24801	46
15	8.75352	9.99930	8.75422	11.24577	45
16	8.75574	9.99929	8.75645	11.24354	44
17	8.75795	9.99928	8.75866	11.24133	43
18	8.76015	9.99927	8.76087	11.23912	42
19	8.76233	9.99927	8.76306	11.23693	41
20	8.76451	9.99926	8.76524	11.23475	40
21	8.76667	9.99925	8.76741	11.23258	39
22	8.76882	9.99924	8.76957	11.23042	38
23	8.77096	9.99924	8.77172	11.22827	37
24	8.77310	9.99923	8.77386	11.22613	36
25	8.77522	9.99922	8.77599	11.22400	35
26	8.77733	9.99921	8.77811	11.22188	34
27	8.77943	9.99921	8.78022	11.21977	33
28	8.78152	9.99920	8.78231	11.21768	32
29	8.78360	9.99919	8.78440	11.21559	31
30	8.78567	9.99918	8.78648	11.21351	30
	Cofine.	Sine.	Cotang.	Tangent.	N.

Min.	3 Degrees.				176	
	Sine.	Cofine.	Tangent	Cotang.		
30	8.78567	9.99918	8.78648	11.21351	30	
31	8.78773	9.99918	8.78855	11.21144	29	
32	8.78978	9.99917	8.79061	11.20938	28	
33	8.79182	9.99916	8.79266	11.20733	27	
34	8.79385	9.99915	8.79470	11.20529	26	
35	8.79588	9.99915	8.79673	11.20326	25	
36	8.79789	9.99914	8.79875	11.20124	24	
37	8.79989	9.99913	8.80076	11.19923	23	
38	8.80189	9.99912	8.80276	11.19723	22	
39	8.80387	9.99911	8.80475	11.19524	21	
40	8.80585	9.99911	8.80674	11.19325	20	
41	8.80781	9.99910	8.80871	11.19128	19	
42	8.80977	9.99909	8.81068	11.18931	18	
43	8.81172	9.99908	8.81264	11.18735	17	
44	8.81366	9.99907	8.81458	11.18541	16	
45	8.81559	9.99906	8.81652	11.18347	15	
46	8.81752	9.99906	8.81846	11.18153	14	
47	8.81943	9.99905	8.82038	11.17961	13	
48	8.82134	9.99904	8.82229	11.17770	12	
49	8.82324	9.99903	8.82420	11.17579	11	
50	8.82512	9.99902	8.82610	11.17389	10	
51	8.82701	9.99901	8.82799	11.17200	9	
52	8.82888	9.99901	8.82987	11.17012	8	
53	8.83074	9.99900	8.83174	11.16825	7	
54	8.83260	9.99899	8.83361	11.16638	6	
55	8.83445	9.99898	8.83547	11.16452	5	
56	8.83629	9.99897	8.83732	11.16267	4	
57	8.83813	9.99896	8.83916	11.16083	3	
58	8.83995	9.99895	8.84099	11.15900	2	
59	8.84177	9.99894	8.84282	11.15717	1	
60	8.84358	9.99894	8.84464	11.15535	0	
	Cofine.	Sine.	Cotang.	Tangent.	Σ	
93					86 Degrees.	

Min.	4 Degrees.				175
	Sine.	Cofine.	Tangent.	Cotang.	
0	8.84358	9.99894	8.84464	11.15535	60
1	8.84538	9.99893	8.84645	11.15354	59
2	8.84718	9.99892	8.84825	11.15174	58
3	8.84897	9.99891	8.85005	11.14994	57
4	8.85075	9.99890	8.85184	11.14815	56
5	8.85252	9.99889	8.85362	11.14637	55
6	8.85429	9.99888	8.85540	11.14459	54
7	8.85604	9.99887	8.85717	11.14282	53
8	8.85780	9.99886	8.85893	11.14106	52
9	8.85954	9.99885	8.86068	11.13931	51
10	8.86128	9.99885	8.86243	11.13756	50
11	8.86301	9.99884	8.86417	11.13582	49
12	8.86473	9.99883	8.86590	11.13409	48
13	8.86645	9.99882	8.86763	11.13236	47
14	8.86816	9.99881	8.86935	11.13064	46
15	8.86986	9.99880	8.87106	11.12893	45
16	8.87156	9.99879	8.87276	11.12723	44
17	8.87325	9.99878	8.87446	11.12553	43
18	8.87493	9.99877	8.87616	11.12383	42
19	8.87661	9.99876	8.87784	11.12215	41
20	8.87828	9.99875	8.87952	11.12047	40
21	8.87994	9.99874	8.88120	11.11879	39
22	8.88160	9.99873	8.88286	11.11713	38
23	8.88325	9.99872	8.88453	11.11546	37
24	8.88490	9.99871	8.88618	11.11381	36
25	8.88654	9.99870	8.88783	11.11216	35
26	8.88817	9.99869	8.88947	11.11052	34
27	8.88980	9.99868	8.89111	11.10888	33
28	8.89142	9.99867	8.89274	11.10725	32
29	8.89303	9.99866	8.89436	11.10563	31
30	8.89464	9.99865	8.89598	11.10401	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
94					84 Degrees.

Min.	4 Degrees.				175	
	Sine.	Cofine.	Tangent	Cotang.		
30	8.89464	9.99865	8.89598	11.10401	30	
31	8.89624	9.99864	8.89759	11.10240	29	
32	8.89784	9.99863	8.89920	11.10079	28	
33	8.89943	9.99862	8.90080	11.09919	27	
34	8.90101	9.99861	8.90239	11.09760	26	
35	8.90259	9.99860	8.90398	11.09601	25	
36	8.90416	9.99859	8.90556	11.09443	24	
37	8.90573	9.99858	8.90714	11.09285	23	
38	8.90729	9.99857	8.90871	11.09128	22	
39	8.90885	9.99856	8.91028	11.08971	21	
40	8.91040	9.99855	8.91184	11.08815	20	
41	8.91194	9.99854	8.91340	11.08659	19	
42	8.91348	9.99853	8.91495	11.08504	18	
43	8.91502	9.99852	8.91649	11.08350	17	
44	8.91655	9.99851	8.91803	11.08196	16	
45	8.91807	9.99850	8.91956	11.08043	15	
46	8.91959	9.99849	8.92109	11.07890	14	
47	8.92110	9.99848	8.92261	11.07738	13	
48	8.92261	9.99847	8.92413	11.07586	12	
49	8.92411	9.99846	8.92564	11.07435	11	
50	8.92560	9.99845	8.92715	11.07284	10	
51	8.92710	9.99844	8.92865	11.07134	9	
52	8.92858	9.99843	8.93015	11.06984	8	
53	8.93006	9.99842	8.93164	11.06835	7	
54	8.93154	9.99840	8.93313	11.06686	6	
55	8.93301	9.99839	8.93461	11.06538	5	
56	8.93448	9.99838	8.93609	11.06390	4	
57	8.93594	9.99837	8.93756	11.06243	3	
58	8.93739	9.99836	8.93903	11.06096	2	
59	8.93884	9.99835	8.94049	11.05950	1	
60	8.94029	9.99834	8.94195	11.05804	0	
	Cofine.	Sine.	Cotang.	Tangent.	Σ	
94					85 Degrees.	

Min.	5 Degrees.				174
	Sine.	Cofine.	Tangent.	Cotang.	
0	8.94029	9.99834	8.94195	11.05804	60
1	8.94173	9.99833	8.94340	11.05659	59
2	8.94317	9.99832	8.94485	11.05514	58
3	8.94460	9.99831	8.94629	11.05370	57
4	8.94603	9.99829	8.94773	11.05226	56
5	8.94745	9.99828	8.94916	11.05083	55
6	8.94887	9.99827	8.95059	11.04940	54
7	8.95028	9.99826	8.95202	11.04797	53
8	8.95169	9.99825	8.95344	11.04655	52
9	8.95309	9.99824	8.95485	11.04514	51
10	8.95449	9.99823	8.95626	11.04373	50
11	8.95589	9.99822	8.95767	11.04232	49
12	8.95728	9.99820	8.95907	11.04092	48
13	8.95867	9.99819	8.96047	11.03952	47
14	8.96005	9.99818	8.96186	11.03813	46
15	8.96142	9.99817	8.96325	11.03674	45
16	8.96280	9.99816	8.96463	11.03536	44
17	8.96416	9.99815	8.96601	11.03398	43
18	8.96553	9.99813	8.96739	11.03260	42
19	8.96689	9.99812	8.96876	11.03123	41
20	8.96824	9.99811	8.97013	11.02986	40
21	8.96959	9.99810	8.97149	11.02850	39
22	8.97094	9.99809	8.97285	11.02714	38
23	8.97228	9.99808	8.97420	11.02579	37
24	8.97362	9.99806	8.97555	11.02444	36
25	8.97496	9.99805	8.97690	11.02309	35
26	8.97629	9.99804	8.97824	11.02175	34
27	8.97761	9.99803	8.97958	11.02041	33
28	8.97894	9.99802	8.98092	11.01907	32
29	8.98025	9.99800	8.98225	11.01774	31
30	8.98157	9.99799	8.98357	11.01642	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
95					84 Degrees.

Min.	5 Degrees.				174	
	Sine.	Cofine.	Tangent.	Cotang.		
30	8.98157	9.99799	8.98357	11.01642	30	
31	8.98288	9.99798	8.98489	11.01510	29	
32	8.98418	9.99797	8.98621	11.01378	28	
33	8.98549	9.99795	8.98753	11.01246	27	
34	8.98678	9.99794	8.98884	11.01115	26	
35	8.98808	9.99793	8.99014	11.00985	25	
36	8.98937	9.99792	8.99145	11.00854	24	
37	8.99066	9.99790	8.99275	11.00724	23	
38	8.99194	9.99789	8.99404	11.00595	22	
39	8.99322	9.99788	8.99533	11.00466	21	
40	8.99449	9.99787	8.99662	11.00337	20	
41	8.99576	9.99785	8.99790	11.00209	19	
42	8.99703	9.99784	8.99918	11.00081	18	
43	8.99829	9.99783	9.00046	10.99953	17	
44	8.99955	9.99782	9.00173	10.99826	16	
45	9.00081	9.99780	9.00300	10.99699	15	
46	9.00206	9.99779	9.00427	10.99572	14	
47	9.00331	9.99778	9.00553	10.99446	13	
48	9.00456	9.99777	9.00679	10.99320	12	
49	9.00580	9.99775	9.00804	10.99195	11	
50	9.00704	9.99774	9.00929	10.99070	10	
51	9.00827	9.99773	9.01054	10.98945	9	
52	9.00950	9.99771	9.01179	10.98820	8	
53	9.01073	9.99770	9.01303	10.98696	7	
54	9.01196	9.99769	9.01426	10.98573	6	
55	9.01318	9.99768	9.01550	10.98449	5	
56	9.01439	9.99766	9.01673	10.98326	4	
57	9.01561	9.99765	9.01795	10.98204	3	
58	9.01682	9.99764	9.01918	10.98081	2	
59	9.01803	9.99762	9.02040	10.97959	1	
60	9.01923	9.99761	9.02162	10.97837	0	
	Cofine.	Sine.	Cotang.	Tangent.	Σ	
95					84 Degrees.	

Min.	6 Degrees.				173
	Sine	Cofine.	Tangent.	Cotang.	
0	9.01923	9.99761	9.02162	10.97837	60
1	9.02043	9.99760	9.02283	10.97716	59
2	9.02163	9.99758	9.02404	10.97595	58
3	9.02282	9.99757	9.02525	10.97474	57
4	9.02401	9.99756	9.02645	10.97354	56
5	9.02520	9.99754	9.02765	10.97234	55
6	9.02638	9.99753	9.02885	10.97114	54
7	9.02756	9.99752	9.03004	10.96995	53
8	9.02874	9.99750	9.03123	10.96876	52
9	9.02991	9.99749	9.03242	10.96757	51
10	9.03108	9.99747	9.03360	10.96639	50
11	9.03225	9.99746	9.03479	10.96520	49
12	9.03342	9.99745	9.03596	10.96403	48
13	9.03458	9.99743	9.03714	10.96285	47
14	9.03574	9.99742	9.03831	10.96168	46
15	9.03689	9.99741	9.03948	10.96051	45
16	9.03804	9.99739	9.04065	10.95934	44
17	9.03919	9.99738	9.04181	10.95818	43
18	9.04034	9.99736	9.04297	10.95702	42
19	9.04148	9.99735	9.04412	10.95587	41
20	9.04262	9.99734	9.04528	10.95471	40
21	9.04376	9.99732	9.04643	10.95356	39
22	9.04489	9.99731	9.04758	10.95241	38
23	9.04602	9.99729	9.04872	10.95127	37
24	9.04715	9.99728	9.04986	10.95013	36
25	9.04827	9.99727	9.05100	10.94899	35
26	9.04940	9.99725	9.05214	10.94785	34
27	9.05051	9.99724	9.05327	10.94672	33
28	9.05163	9.99722	9.05440	10.94559	32
29	9.05274	9.99721	9.05553	10.94446	31
30	9.05385	9.99719	9.05665	10.94334	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
96					83 Degrees.

6 Degrees.					173
Min.	Sine.	Cofine.	Tangent.	Cotang.	
30	9.05385	9.99719	9.05665	10.94334	30
31	9.05490	9.99718	9.05778	10.94221	29
32	9.05607	9.99717	9.05890	10.94109	28
33	9.05717	9.99715	9.06001	10.93998	27
34	9.05827	9.99714	9.06112	10.93887	26
35	9.05936	9.99712	9.06224	10.93775	25
36	9.06046	9.99711	9.06334	10.93665	24
37	9.06155	9.99709	9.06445	10.93554	23
38	9.06263	9.99708	9.06555	10.93444	22
39	9.06372	9.99706	9.06665	10.93334	21
40	9.06480	9.99705	9.06775	10.93224	20
41	9.06588	9.99703	9.06884	10.93115	19
42	9.06696	9.99702	9.06993	10.93006	18
43	9.06803	9.99700	9.07102	10.92897	17
44	9.06910	9.99699	9.07211	10.92788	16
45	9.07017	9.99697	9.07319	10.92680	15
46	9.07124	9.99696	9.07427	10.92572	14
47	9.07230	9.99694	9.07535	10.92464	13
48	9.07336	9.99693	9.07643	10.92356	12
49	9.07442	9.99691	9.07750	10.92249	11
50	9.07547	9.99690	9.07857	10.92142	10
51	9.07653	9.99688	9.07964	10.92035	9
52	9.07758	9.99687	9.08070	10.91929	8
53	9.07863	9.99685	9.08177	10.91822	7
54	9.07967	9.99684	9.08283	10.91716	6
55	9.08071	9.99682	9.08389	10.91610	5
56	9.08175	9.99681	9.08494	10.91505	4
57	9.08279	9.99679	9.08599	10.91400	3
58	9.08383	9.99678	9.08705	10.91294	2
59	9.08486	9.99676	9.08809	10.91190	1
60	9.08589	9.99675	9.08914	10.91085	0
	Cofine.	Sine.	Cotang.	Tangent.	Σ
96	83 Degrees.				

Min.	7 Degrees.				172
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.08589	9.99675	9.08914	10.91085	60
1	9.08692	9.99673	9.09018	10.90981	59
2	9.08794	9.99671	9.09122	10.90877	58
3	9.08897	9.99670	9.09226	10.90773	57
4	9.08999	9.99668	9.09330	10.90669	56
5	9.09100	9.99667	9.09433	10.90566	55
6	9.09202	9.99665	9.09536	10.90463	54
7	9.09303	9.99664	9.09639	10.90360	53
8	9.09404	9.99662	9.09742	10.90257	52
9	9.09505	9.99660	9.09844	10.90155	51
10	9.09606	9.99659	9.09946	10.90053	50
11	9.09706	9.99657	9.10048	10.89951	49
12	9.09806	9.99656	9.10150	10.89849	48
13	9.09906	9.99654	9.10251	10.89748	47
14	9.10006	9.99652	9.10353	10.89646	46
15	9.10105	9.99651	9.10454	10.89545	45
16	9.10204	9.99649	9.10555	10.89445	44
17	9.10303	9.99648	9.10655	10.89344	43
18	9.10402	9.99646	9.10755	10.89244	42
19	9.10500	9.99644	9.10856	10.89143	41
20	9.10599	9.99643	9.10955	10.89044	40
21	9.10697	9.99641	9.11055	10.88944	39
22	9.10795	9.99640	9.11155	10.88844	38
23	9.10892	9.99638	9.11254	10.88745	37
24	9.10990	9.99636	9.11353	10.88646	36
25	9.11087	9.99635	9.11452	10.88547	35
26	9.11184	9.99633	9.11550	10.88449	34
27	9.11280	9.99631	9.11649	10.88350	33
28	9.11377	9.99630	9.11747	10.88252	32
29	9.11473	9.99628	9.11845	10.88154	31
30	9.11569	9.99626	9.11942	10.88057	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
97					82 Degrees.

Min.	7 Degrees.				172	
	Sine.	Cofine.	Tangent.	Cotang.		
30	9.11569	9.99626	9.11942	10.88057	30	
31	9.11665	9.99625	9.12040	10.87959	29	
32	9.11761	9.99623	9.12137	10.87862	28	
33	9.11856	9.99621	9.12234	10.87765	27	
34	9.11951	9.99610	9.12331	10.87668	26	
35	9.12046	9.99618	9.12428	10.87571	25	
36	9.12141	9.99616	9.12524	10.87475	24	
37	9.12236	9.99615	9.12621	10.87378	23	
38	9.12330	9.99613	9.12717	10.87282	22	
39	9.12424	9.99611	9.12813	10.87186	21	
40	9.12518	9.99610	9.12908	10.87091	20	
41	9.12612	9.99608	9.13004	10.86995	19	
42	9.12706	9.99606	9.13099	10.86900	18	
43	9.12799	9.99604	9.13194	10.86805	17	
44	9.12892	9.99603	9.13289	10.86710	16	
45	9.12985	9.99601	9.13383	10.86616	15	
46	9.13078	9.99599	9.13478	10.86521	14	
47	9.13170	9.99598	9.13572	10.86427	13	
48	9.13262	9.99596	9.13666	10.86333	12	
49	9.13355	9.99594	9.13760	10.86239	11	
50	9.13447	9.99592	9.13854	10.86145	10	
51	9.13538	9.99591	9.13947	10.86052	9	
52	9.13630	9.99589	9.14040	10.85959	8	
53	9.13721	9.99587	9.14134	10.85866	7	
54	9.13812	9.99585	9.14226	10.85773	6	
55	9.13903	9.99584	9.14319	10.85680	5	
56	9.13994	9.99582	9.14412	10.85587	4	
57	9.14085	9.99580	9.14504	10.85495	3	
58	9.14175	9.99578	9.14596	10.85403	2	
59	9.14265	9.99577	9.14688	10.85311	1	
60	9.14355	9.99575	9.14780	10.85219	0	
	Cofine.	Sine.	Cotang.	Tangent.	Σ	
97					82 Degrees.	

Min.	8 Degrees.				171
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.14355	9.99575	9.14780	10.85219	60
1	9.14445	9.99573	9.14871	10.85128	59
2	9.14534	9.99571	9.14963	10.85036	58
3	9.14624	9.99569	9.15054	10.84945	57
4	9.14713	9.99568	9.15145	10.84854	56
5	9.14802	9.99566	9.15236	10.84763	55
6	9.14891	9.99564	9.15326	10.84673	54
7	9.14980	9.99562	9.15417	10.84582	53
8	9.15068	9.99560	9.15507	10.84492	52
9	9.15156	9.99559	9.15597	10.84402	51
10	9.15245	9.99557	9.15687	10.84312	50
11	9.15333	9.99555	9.15777	10.84222	49
12	9.15420	9.99553	9.15867	10.84132	48
13	9.15508	9.99551	9.15956	10.84043	47
14	9.15595	9.99550	9.16045	10.83954	46
15	9.15682	9.99548	9.16134	10.83865	45
16	9.15770	9.99546	9.16223	10.83776	44
17	9.15856	9.99544	9.16312	10.83687	43
18	9.15943	9.99542	9.16400	10.83599	42
19	9.16030	9.99540	9.16489	10.83510	41
20	9.16116	9.99539	9.16577	10.83422	40
21	9.16202	9.99537	9.16665	10.83334	39
22	9.16288	9.99535	9.16753	10.83246	38
23	9.16374	9.99533	9.16840	10.83159	37
24	9.16459	9.99531	9.16928	10.83071	36
25	9.16545	9.99529	9.17 15	10.82984	35
26	9.16630	9.99527	9.17102	10.82897	34
27	9.16715	9.99525	9.17189	10.82810	33
28	9.16800	9.99524	9.17276	10.82723	32
29	9.16885	9.99522	9.17363	10.82636	31
30	9.16970	9.99520	9.17449	10.82550	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
98					81 Degrees.

Min.	8 Degrees.				171
	Sine.	Cofine.	Tangent.	Cotang.	
30	9.16970	9.99520	9.17449	10.82550	30
31	9.17054	9.99518	9.17536	10.82463	29
32	9.17138	9.99516	9.17622	10.82377	28
33	9.17223	9.99514	9.17708	10.82291	27
34	9.17306	9.99512	9.17794	10.82205	26
35	9.17390	9.99510	9.17879	10.82120	25
36	9.17474	9.99508	9.17965	10.82034	24
37	9.17557	9.99507	9.18050	10.81949	23
38	9.17641	9.99505	9.18136	10.81863	22
39	9.17724	9.99503	9.18221	10.81778	21
40	9.17807	9.99501	9.18305	10.81694	20
41	9.17890	9.99499	9.18390	10.81609	19
42	9.17972	9.99497	9.18475	10.81524	18
43	9.18055	9.99495	9.18559	10.81440	17
44	9.18137	9.99493	9.18643	10.81356	16
45	9.18219	9.99491	9.18728	10.81271	15
46	9.18301	9.99489	9.18811	10.81188	14
47	9.18383	9.99487	9.18895	10.81104	13
48	9.18465	9.99485	9.18979	10.81020	12
49	9.18546	9.99483	9.19062	10.80937	11
50	9.18628	9.99481	9.19146	10.80853	10
51	9.18709	9.99479	9.19229	10.80770	9
52	9.18790	9.99477	9.19312	10.80687	8
53	9.18871	9.99475	9.19395	10.80604	7
54	9.18951	9.99473	9.19478	10.80521	6
55	9.19032	9.99471	9.19560	10.80439	5
56	9.19112	9.99469	9.19643	10.80356	4
57	9.19193	9.99467	9.19725	10.80274	3
58	9.19273	9.99465	9.19807	10.80192	2
59	9.19353	9.99463	9.19889	10.80110	1
60	9.19433	9.99461	9.19971	10.80028	0
	Cofine.	Sine.	Cotang.	Tangent.	M
98					81 Degrees.

Min.	9 Degrees.				170
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.19433	9.99461	9.19971	10.80028	60
1	9.19512	9.99459	9.20052	10.79947	59
2	9.19592	9.99457	9.20134	10.79865	58
3	9.19671	9.99455	9.20215	10.79784	57
4	9.19751	9.99453	9.20297	10.79702	56
5	9.19830	9.99451	9.20378	10.79621	55
6	9.19909	9.99449	9.20459	10.79540	54
7	9.19987	9.99447	9.20540	10.79459	53
8	9.20066	9.99445	9.20620	10.79379	52
9	9.20145	9.99443	9.20701	10.79298	51
10	9.20223	9.99441	9.20781	10.79218	50
11	9.20301	9.99439	9.20861	10.79138	49
12	9.20379	9.99437	9.20942	10.79057	48
13	9.20457	9.99435	9.21022	10.78978	47
14	9.20535	9.99433	9.21101	10.78898	46
15	9.20613	9.99431	9.21181	10.78818	45
16	9.20690	9.99429	9.21261	10.78738	44
17	9.20767	9.99427	9.21340	10.78659	43
18	9.20845	9.99425	9.21419	10.78580	42
19	9.20922	9.99423	9.21498	10.78501	41
20	9.20999	9.99421	9.21577	10.78422	40
21	9.21075	9.99419	9.21656	10.78343	39
22	9.21152	9.99417	9.21735	10.78264	38
23	9.21229	9.99414	9.21814	10.78185	37
24	9.21305	9.99412	9.21892	10.78107	36
25	9.21381	9.99410	9.21970	10.78029	35
26	9.21457	9.99408	9.22049	10.77950	34
27	9.21533	9.99406	9.22127	10.77872	33
28	9.21609	9.99404	9.22205	10.77794	32
29	9.21685	9.99402	9.22282	10.77717	31
30	9.21760	9.99400	9.22360	10.77639	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
99					80 Degrees.

Min.	9 Degrees.				170
	Sine.	Cosine.	Tangent.	Cotang.	
30	9.21760	9.99400	9.22360	10.77639	30
31	9.21836	9.99398	9.22438	10.77561	29
32	9.21911	9.99396	9.22515	10.77484	28
33	9.21986	9.99393	9.22592	10.77407	27
34	9.22061	9.99391	9.22670	10.77329	26
35	9.22136	9.99389	9.22747	10.77252	25
36	9.22211	9.99387	9.22823	10.77176	24
37	9.22286	9.99385	9.22900	10.77099	23
38	9.22360	9.99383	9.22977	10.77022	22
39	9.22434	9.99381	9.23053	10.76946	21
40	9.22509	9.99378	9.23130	10.76869	20
41	9.22583	9.99376	9.23206	10.76793	19
42	9.22657	9.99374	9.23282	10.76717	18
43	9.22731	9.99372	9.23358	10.76641	17
44	9.22804	9.99370	9.23434	10.76565	16
45	9.22878	9.99368	9.23510	10.76489	15
46	9.22951	9.99365	9.23585	10.76414	14
47	9.23025	9.99363	9.23661	10.76338	13
48	9.23098	9.99361	9.23736	10.76263	12
49	9.23171	9.99359	9.23812	10.76187	11
50	9.23244	9.99357	9.23887	10.76112	10
51	9.23317	9.99355	9.23962	10.76037	9
52	9.23389	9.99352	9.24037	10.75962	8
53	9.23462	9.99350	9.24111	10.75888	7
54	9.23534	9.99348	9.24186	10.75813	6
55	9.23607	9.99346	9.24261	10.75738	5
56	9.23679	9.99344	9.24335	10.75664	4
57	9.23751	9.99341	9.24409	10.75590	3
58	9.23823	9.99339	9.24483	10.75516	2
59	9.23895	9.99337	9.24557	10.75442	1
60	9.23967	9.99335	9.24631	10.75368	0
	Cosine.	Sine.	Cotang.	Tangent.	Σ
99					80 Degrees.

10 Degrees.					169
Min.	Sine.	Cofine.	Tangent.	Cotang.	
0	9.23967	9.99335	9.24631	10.75368	60
1	9.24038	9.99332	9.24705	10.75294	59
2	9.24110	9.99330	9.24779	10.75220	58
3	9.24181	9.99328	9.24852	10.75147	57
4	9.24252	9.99326	9.24926	10.75073	56
5	9.24323	9.99323	9.24999	10.75000	55
6	9.24394	9.99321	9.25073	10.74926	54
7	9.24465	9.99319	9.25146	10.74853	53
8	9.24536	9.99317	9.25219	10.74780	52
9	9.24606	9.99314	9.25292	10.74708	51
10	9.24677	9.99312	9.25364	10.74635	50
11	9.24747	9.99310	9.25437	10.74562	49
12	9.24818	9.99308	9.25509	10.74490	48
13	9.24888	9.99305	9.25582	10.74417	47
14	9.24958	9.99303	9.25654	10.74345	46
15	9.25028	9.99301	9.25726	10.74273	45
16	9.25098	9.99299	9.25799	10.74200	44
17	9.25167	9.99296	9.25870	10.74129	43
18	9.25237	9.99294	9.25942	10.74057	42
19	9.25306	9.99292	9.26014	10.73985	41
20	9.25376	9.99289	9.26086	10.73913	40
21	9.25445	9.99287	9.26157	10.73842	39
22	9.25514	9.99285	9.26229	10.73770	38
23	9.25583	9.99282	9.26300	10.73699	37
24	9.25652	9.99280	9.26371	10.73628	36
25	9.25721	9.99278	9.26442	10.73557	35
26	9.25789	9.99275	9.26513	10.73486	34
27	9.25858	9.99273	9.26584	10.73415	33
28	9.25926	9.99271	9.26655	10.73344	32
29	9.25995	9.99268	9.26726	10.73273	31
30	9.26063	9.99266	9.26796	10.73203	30
	Cofine.	Sine.	Cotang.	Tangent.	N
100					
	79 Degrees.				

Min.	10 Degrees.				169
	Sine.	Cofine.	Tangent.	Cotang.	
30	9.26063	9.99266	9.26796	10.73203	30
31	9.26131	9.99264	9.26867	10.73132	29
32	9.26199	9.99261	9.26937	10.73062	28
33	9.26267	9.99259	9.27007	10.72992	27
34	9.26335	9.99257	9.27077	10.72922	26
35	9.26402	9.99254	9.27147	10.72852	25
36	9.26470	9.99252	9.27217	10.72782	24
37	9.26537	9.99250	9.27287	10.72712	23
38	9.26605	9.99247	9.27357	10.72642	22
39	9.26672	9.99245	9.27426	10.72573	21
40	9.26739	9.99243	9.27496	10.72503	20
41	9.26806	9.99240	9.27565	10.72434	19
42	9.26873	9.99238	9.27635	10.72364	18
43	9.26940	9.99235	9.27704	10.72295	17
44	9.27006	9.99233	9.27773	10.72226	16
45	9.27073	9.99231	9.27812	10.72157	15
46	9.27139	9.99228	9.27911	10.72088	14
47	9.27206	9.99226	9.27980	10.72019	13
48	9.27272	9.99223	9.28048	10.71951	12
49	9.27338	9.99221	9.28117	10.71882	11
50	9.27404	9.99219	9.28185	10.71814	10
51	9.27470	9.99216	9.28254	10.71745	9
52	9.27536	9.99214	9.28322	10.71677	8
53	9.27602	9.99211	9.28390	10.71609	7
54	9.27668	9.99209	9.28458	10.71541	6
55	9.27733	9.99206	9.28526	10.71473	5
56	9.27799	9.99204	9.28594	10.71405	4
57	9.27864	9.99202	9.28662	10.71337	3
58	9.27929	9.99199	9.28730	10.71269	2
59	9.27994	9.99197	9.28797	10.71202	1
60	9.28059	9.99194	9.28865	10.71134	0
	Cofine.	Sine.	Cotang.	Tangent.	Σ
100				79 Degrees	

Min.	11 Degrees.				168
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.28059	9.99194	9.28865	10.71134	60
1	9.28124	9.99192	9.28932	10.71067	59
2	9.28189	9.99189	9.28999	10.71000	58
3	9.28254	9.99187	9.29067	10.70932	57
4	9.28319	9.99184	9.29134	10.70865	56
5	9.28383	9.99182	9.29201	10.70798	55
6	9.28448	9.99179	9.29208	10.70731	54
7	9.28512	9.99177	9.29335	10.70665	53
8	9.28576	9.99174	9.29401	10.70598	52
9	9.28640	9.99172	9.29468	10.70531	51
10	9.28704	9.99169	9.29534	10.70465	50
11	9.28768	9.99167	9.29601	10.70398	49
12	9.28832	9.99164	9.29667	10.70332	48
13	9.28896	9.99162	9.29733	10.70266	47
14	9.28960	9.99159	9.29800	10.70199	46
15	9.29023	9.99157	9.29866	10.70133	45
16	9.29087	9.99154	9.29932	10.70067	44
17	9.29150	9.99152	9.29998	10.70001	43
18	9.29213	9.99149	9.30063	10.69936	42
19	9.29276	9.99147	9.30129	10.69870	41
20	9.29339	9.99144	9.30195	10.69804	40
21	9.29402	9.99142	9.30260	10.69739	39
22	9.29465	9.99139	9.30326	10.69673	38
23	9.29528	9.99137	9.30391	10.69608	37
24	9.29591	9.99134	9.30456	10.69543	36
25	9.29653	9.99132	9.30521	10.69478	35
26	9.29716	9.99129	9.30586	10.69413	34
27	9.29778	9.99126	9.30651	10.69348	33
28	9.29841	9.99124	9.30716	10.69283	32
29	9.29903	9.99121	9.30781	10.69218	31
30	9.29965	9.99119	9.30846	10.69153	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
	101			78 Degrees.	

Min.	11 Degrees.				108
	Sine.	Cofine.	Tangent.	Cotang.	
30	9.29965	9.99119	9.30846	10.69153	30
31	9.30027	9.99116	9.30910	10.69089	29
32	9.30089	9.99114	9.30975	10.69024	28
33	9.30151	9.99111	9.31039	10.68960	27
34	9.30213	9.99108	9.31104	10.68895	26
35	9.30274	9.99106	9.31168	10.68831	25
36	9.30336	9.99103	9.31232	10.68767	24
37	9.30397	9.99101	9.31296	10.68703	23
38	9.30459	9.99098	9.31360	10.68639	22
39	9.30520	9.99095	9.31424	10.68575	21
40	9.30581	9.99093	9.31488	10.68511	20
41	9.30643	9.99090	9.31552	10.68447	19
42	9.30704	9.99088	9.31615	10.68384	18
43	9.30765	9.99085	9.31679	10.68320	17
44	9.30825	9.99082	9.31742	10.68257	16
45	9.30886	9.99080	9.31806	10.68193	15
46	9.30947	9.99077	9.31869	10.68130	14
47	9.31007	9.99075	9.31932	10.68067	13
48	9.31068	9.99072	9.31996	10.68003	12
49	9.31128	9.99069	9.32059	10.67940	11
50	9.31189	9.99067	9.32122	10.67877	10
51	9.31249	9.99064	9.32185	10.67814	9
52	9.31309	9.99061	9.32247	10.67752	8
53	9.31369	9.99059	9.32310	10.67689	7
54	9.31429	9.99056	9.32373	10.67626	6
55	9.31489	9.99053	9.32435	10.67564	5
56	9.31549	9.99051	9.32498	10.67501	4
57	9.31609	9.99048	9.32560	10.67439	3
58	9.31668	9.99045	9.32623	10.67376	2
59	9.31728	9.99043	9.32685	10.67314	1
60	9.31787	9.99040	9.32747	10.67252	0
	Cofine.	Sine.	Cotang.	Tangent.	M
101					78 Degrees.

Min.	12 Degrees.				167
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.31787	9.99040	9.32747	10.67252	60
1	9.31847	9.99037	9.32809	10.67190	59
2	9.31906	9.99035	9.32871	10.67128	58
3	9.31965	9.99032	9.32933	10.67066	57
4	9.32024	9.99029	9.32995	10.67004	56
5	9.32084	9.99026	9.33057	10.66942	55
6	9.32142	9.99024	9.33118	10.66881	54
7	9.32201	9.99021	9.33180	10.66819	53
8	9.32260	9.99018	9.33241	10.66758	52
9	9.32319	9.99016	9.33303	10.66696	51
10	9.32378	9.99013	9.33364	10.66635	50
11	9.32436	9.99010	9.33425	10.66574	49
12	9.32495	9.99007	9.33487	10.66512	48
13	9.32553	9.99005	9.33548	10.66451	47
14	9.32611	9.99002	9.33609	10.66390	46
15	9.32669	9.98999	9.33670	10.66329	45
16	9.32728	9.98996	9.33731	10.66268	44
17	9.32786	9.98994	9.33791	10.66208	43
18	9.32844	9.98991	9.33852	10.66147	42
19	9.32902	9.98988	9.33913	10.66086	41
20	9.32959	9.98985	9.33973	10.66026	40
21	9.33017	9.98983	9.34034	10.65965	39
22	9.33075	9.98980	9.34094	10.65905	38
23	9.33132	9.98977	9.34155	10.65844	37
24	9.33190	9.98974	9.34215	10.65784	36
25	9.33247	9.98972	9.34275	10.65724	35
26	9.33305	9.98969	9.34335	10.65664	34
27	9.33362	9.98966	9.34395	10.65604	33
28	9.33419	9.98963	9.34455	10.65544	32
29	9.33476	9.98960	9.34515	10.65484	31
30	9.33533	9.98958	9.34575	10.65424	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
102					77 Degrees.

Min.	12 Degrees.				167
	Sine.	Cofine.	Tangent.	Cotang.	
30	9.33533	9.98958	9.34575	10.65424	30
31	9.33590	9.98955	9.34635	10.65364	29
32	9.33647	9.98952	9.34694	10.65305	28
33	9.33704	9.98949	9.34754	10.65245	27
34	9.33760	9.98946	9.34814	10.65185	26
35	9.33817	9.98944	9.34873	10.65126	25
36	9.33874	9.98941	9.34932	10.65067	24
37	9.33930	9.98938	9.34992	10.65007	23
38	9.33987	9.98935	9.35051	10.64948	22
39	9.34043	9.98932	9.35110	10.64889	21
40	9.34099	9.98929	9.35169	10.64830	20
41	9.34155	9.98927	9.35228	10.64771	19
42	9.34211	9.98924	9.35287	10.64712	18
43	9.34267	9.98921	9.35346	10.64653	17
44	9.34323	9.98918	9.35405	10.64594	16
45	9.34379	9.98915	9.35464	10.64535	15
46	9.34435	9.98912	9.35522	10.64477	14
47	9.34491	9.98909	9.35581	10.64418	13
48	9.34546	9.98907	9.35639	10.64360	12
49	9.34602	9.98904	9.35698	10.64301	11
50	9.34657	9.98901	9.35756	10.64243	10
51	9.34713	9.98898	9.35814	10.64185	9
52	9.34768	9.98895	9.35873	10.64126	8
53	9.34823	9.98892	9.35931	10.64068	7
54	9.34879	9.98889	9.35989	10.64010	6
55	9.34934	9.98886	9.36047	10.63952	5
56	9.34989	9.98884	9.36105	10.63894	4
57	9.35044	9.98881	9.36163	10.63836	3
58	9.35099	9.98878	9.36221	10.63779	2
59	9.35154	9.98875	9.36278	10.63721	1
60	9.35208	9.98872	9.36336	10.63663	0
	Cofine.	Sine.	Cotang.	Tangent.	Σ
102					77 Degrees.

Min.	13 Degrees.				166
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.35208	9.98872	9.36336	10.63663	60
1	9.35263	9.98869	9.36394	10.63605	59
2	9.35318	9.98866	9.36451	10.63548	58
3	9.35372	9.98863	9.36509	10.63490	57
4	9.35427	9.98860	9.36566	10.63433	56
5	9.35481	9.98857	9.36623	10.63376	55
6	9.35535	9.98854	9.36681	10.63319	54
7	9.35590	9.98851	9.36738	10.63261	53
8	9.35644	9.98848	9.36795	10.63204	52
9	9.35698	9.98845	9.36852	10.63147	51
10	9.35752	9.98843	9.36909	10.63090	50
11	9.35806	9.98840	9.36966	10.63033	49
12	9.35860	9.98837	9.37023	10.62976	48
13	9.35914	9.98834	9.37079	10.62920	47
14	9.35967	9.98831	9.37136	10.62863	46
15	9.36031	9.98828	9.37193	10.62806	45
16	9.36075	9.98825	9.37249	10.62750	44
17	9.36128	9.98822	9.37306	10.62693	43
18	9.36182	9.98819	9.37362	10.62637	42
19	9.36235	9.98816	9.37419	10.62580	41
20	9.36288	9.98813	9.37475	10.62524	40
21	9.36342	9.98810	9.37531	10.62468	39
22	9.36395	9.98807	9.37588	10.62411	38
23	9.36448	9.98804	9.37644	10.62355	37
24	9.36501	9.98801	9.37700	10.62299	36
25	9.36554	9.98798	9.37756	10.62243	35
26	9.36607	9.98795	9.37812	10.62187	34
27	9.36660	9.98792	9.37868	10.62131	33
28	9.36713	9.98789	9.37923	10.62076	32
29	9.36765	9.98786	9.37979	10.62020	31
30	9.36818	9.98783	9.38035	10.61964	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
	103			76 Degrees.	

Min.	13 Degrees.				165	
	Sine.	Cofine.	Tangent.	Cotang.		
30	9.36818	9.98783	9.38035	10.61964	30	
31	9.36871	9.98780	9.38091	10.61909	29	
32	9.36923	9.98777	9.38146	10.61853	28	
33	9.36976	9.98774	9.38202	10.61797	27	
34	9.37028	9.98770	9.38257	10.61742	26	
35	9.37080	9.98767	9.38312	10.61687	25	
36	9.37133	9.98764	9.38368	10.61631	24	
37	9.37185	9.98761	9.38423	10.61576	23	
38	9.37237	9.98758	9.38478	10.61521	22	
39	9.37289	9.98755	9.38533	10.61466	21	
40	9.37341	9.98752	9.38588	10.61411	20	
41	9.37393	9.98749	9.38643	10.61356	19	
42	9.37445	9.98746	9.38698	10.61301	18	
43	9.37496	9.98743	9.38753	10.61246	17	
44	9.37548	9.98740	9.38808	10.61191	16	
45	9.37600	9.98737	9.38863	10.61136	15	
46	9.37651	9.98734	9.38917	10.61082	14	
47	9.37703	9.98731	9.38972	10.61027	13	
48	9.37754	9.98727	9.39027	10.60973	12	
49	9.37806	9.98724	9.39081	10.60918	11	
50	9.37857	9.98721	9.39135	10.60864	10	
51	9.37908	9.98718	9.39190	10.60809	9	
52	9.37960	9.98715	9.39244	10.60755	8	
53	9.38011	9.98712	9.39298	10.60701	7	
54	9.38062	9.98709	9.39353	10.60646	6	
55	9.38113	9.98706	9.39407	10.60592	5	
56	9.38164	9.98702	9.39461	10.60538	4	
57	9.38215	9.98699	9.39515	10.60484	3	
58	9.38266	9.98696	9.39569	10.60430	2	
59	9.38316	9.98693	9.39623	10.60376	1	
60	9.38367	9.98690	9.39677	10.60322	0	
	Cofine.	Sine.	Cotang.	Tangent.	Σ	
103						76 Degrees.

Min.	14 Degrees.				165
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.38367	9.98690	9.39677	10.60322	60
1	9.38418	9.98687	9.39730	10.60269	59
2	9.38468	9.98684	9.39784	10.60215	58
3	9.38519	9.98680	9.39838	10.60161	57
4	9.38569	9.98677	9.39891	10.60108	56
5	9.38620	9.98674	9.39945	10.60054	55
6	9.38670	9.98671	9.39998	10.60001	54
7	9.38720	9.98668	9.40052	10.59947	53
8	9.38770	9.98665	9.40105	10.59894	52
9	9.38821	9.98661	9.40159	10.59840	51
10	9.38871	9.98658	9.40212	10.59787	50
11	9.38921	9.98655	9.40265	10.59734	49
12	9.38971	9.98652	9.40318	10.59681	48
13	9.39020	9.98649	9.40371	10.59628	47
14	9.39070	9.98645	9.40424	10.59575	46
15	9.39120	9.98642	9.40477	10.59522	45
16	9.39170	9.98639	9.40530	10.59469	44
17	9.39219	9.98636	9.40583	10.59416	43
18	9.39267	9.98633	9.40636	10.59363	42
19	9.39319	9.98629	9.40689	10.59310	41
20	9.39368	9.98626	9.40741	10.59258	40
21	9.39417	9.98623	9.40794	10.59205	39
22	9.39467	9.98620	9.40847	10.59152	38
23	9.39516	9.98616	9.40899	10.59100	37
24	9.39565	9.98613	9.40952	10.59047	36
25	9.39614	9.98610	9.41004	10.58995	35
26	9.39664	9.98607	9.41056	10.58943	34
27	9.39713	9.98603	9.41109	10.58890	33
28	9.39762	9.98600	9.41161	10.58838	32
29	9.39811	9.98597	9.41213	10.58786	31
30	9.39859	9.98594	9.41265	10.58734	30
	Cofine	Sine.	Cotang.	Tangent.	Σ
104					75 Degrees.

14 Degrees.					165
Min.	Sine.	Cofine.	Tangent	Cotang.	
30	9.39859	9.98594	9.41265	10.58734	30
31	9.39908	9.98590	9.41317	10.58682	29
32	9.39957	9.98587	9.41369	10.58630	28
33	9.40006	9.98584	9.41421	10.58578	27
34	9.40054	9.98581	9.41473	10.58526	26
35	9.40103	9.98577	9.41525	10.58474	25
36	9.40152	9.98574	9.41577	10.58422	24
37	9.40200	9.98571	9.41629	10.58370	23
38	9.40248	9.98567	9.41680	10.58319	22
39	9.40297	9.98564	9.41732	10.58267	21
40	9.40345	9.98561	9.41784	10.58215	20
41	9.40393	9.98557	9.41835	10.58164	19
42	9.40441	9.98554	9.41887	10.58112	18
43	9.40490	9.98551	9.41938	10.58061	17
44	9.40538	9.98548	9.41990	10.58009	16
45	9.40586	9.98544	9.42041	10.57958	15
46	9.40634	9.98541	9.42092	10.57907	14
47	9.40682	9.98538	9.42143	10.57856	13
48	9.40729	9.98534	9.42195	10.57804	12
49	9.40777	9.98531	9.42246	10.57753	11
50	9.40825	9.98528	9.42297	10.57702	10
51	9.40873	9.98524	9.42348	10.57651	9
52	9.40920	9.98521	9.42399	10.57600	8
53	9.40968	9.98517	9.42450	10.57549	7
54	9.41015	9.98514	9.42501	10.57498	6
55	9.41063	9.98511	9.42551	10.57448	5
56	9.41110	9.98507	9.42602	10.57397	4
57	9.41157	9.98504	9.42653	10.57346	3
58	9.41205	9.98501	9.42704	10.57295	2
59	9.41252	9.98497	9.42754	10.57245	1
60	9.41299	9.98494	9.42805	10.57194	0
	Cofine.	Sine.	Cotang.	Tangent.	Σ
104					75 Degrees.

Min.	15 Degrees.				164
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.41299	9.98494	9.42805	10.57194	60
1	9.41346	9.98490	9.42855	10.57144	59
2	9.41393	9.98487	9.42906	10.57093	58
3	9.41440	9.98484	9.42956	10.57043	57
4	9.41487	9.98480	9.43006	10.56993	56
5	9.41534	9.98477	9.43057	10.56942	55
6	9.41581	9.98474	9.43107	10.56892	54
7	9.41628	9.98470	9.43157	10.56842	53
8	9.41675	9.98467	9.43207	10.56792	52
9	9.41721	9.98463	9.43257	10.56742	51
10	9.41768	9.98460	9.43308	10.56691	50
11	9.41814	9.98456	9.43358	10.56641	49
12	9.41861	9.98453	9.43408	10.56592	48
13	9.41907	9.98450	9.43457	10.56542	47
14	9.41954	9.98446	9.43507	10.56492	46
15	9.42000	9.98443	9.43557	10.56442	45
16	9.42047	9.98439	9.43607	10.56392	44
17	9.42093	9.98436	9.43657	10.56342	43
18	9.42139	9.98432	9.43706	10.56293	42
19	9.42185	9.98429	9.43756	10.56243	41
20	9.42231	9.98425	9.43805	10.56194	40
21	9.42277	9.98422	9.43855	10.56144	39
22	9.42323	9.98418	9.43904	10.56095	38
23	9.42369	9.98415	9.43954	10.56045	37
24	9.42415	9.98412	9.44003	10.55996	36
25	9.42461	9.98408	9.44052	10.55947	35
26	9.42507	9.98405	9.44102	10.55897	34
27	9.42552	9.98401	9.44151	10.55848	33
28	9.42598	9.98398	9.44200	10.55799	32
29	9.42644	9.98394	9.44249	10.55750	31
30	9.42689	9.98391	9.44298	10.55701	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
105					74 Degrees.

Min.	15 Degrees.				164	
	Sine	Cofine.	Tangent	Cotang.		
30	9.42689	9.98391	9.44298	10.55701	30	
31	9.42735	9.98387	9.44347	10.55652	29	
32	9.42780	9.98384	9.44396	10.55603	28	
33	9.42826	9.98380	9.44445	10.55554	27	
34	9.42871	9.98377	9.44494	10.55505	26	
35	9.42917	9.98373	9.44543	10.55456	25	
36	9.42962	9.98369	9.44592	10.55407	24	
37	9.43007	9.98366	9.44641	10.55358	23	
38	9.43052	9.98362	9.44689	10.55310	22	
39	9.43097	9.98359	9.44738	10.55261	21	
40	9.43142	9.98355	9.44787	10.55212	20	
41	9.43187	9.98352	9.44835	10.55164	19	
42	9.43232	9.98348	9.44884	10.55115	18	
43	9.43277	9.98345	9.44932	10.55067	17	
44	9.43322	9.98341	9.44981	10.55018	16	
45	9.43367	9.98338	9.45029	10.54970	15	
46	9.43412	9.98334	9.45077	10.54922	14	
47	9.43456	9.98330	9.45126	10.54873	13	
48	9.43501	9.98327	9.45174	10.54825	12	
49	9.43546	9.98323	9.45222	10.54777	11	
50	9.43590	9.98320	9.45270	10.54729	10	
51	9.43635	9.98316	9.45318	10.54681	9	
52	9.43679	9.98313	9.45366	10.54633	8	
53	9.43724	9.98309	9.45414	10.54585	7	
54	9.43768	9.98305	9.45462	10.54537	6	
55	9.43812	9.98302	9.45510	10.54489	5	
56	9.43857	9.98298	9.45558	10.54441	4	
57	9.43901	9.98295	9.45606	10.54393	3	
58	9.43945	9.98291	9.45654	10.54345	2	
59	9.43989	9.98287	9.45701	10.54298	1	
60	9.44033	9.98284	9.45749	10.54250	0	
	Cofine.	Sine.	Cotang.	Tangent.	Σ	
105					74 Degrees.	

Min.	16 Degrees.				163
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.44033	9.98284	9.45749	10.54250	60
1	9.44077	9.98280	9.45797	10.54202	59
2	9.44121	9.98276	9.45844	10.54155	58
3	9.44165	9.98273	9.45892	10.54107	57
4	9.44209	9.98269	9.45940	10.54059	56
5	9.44253	9.98266	9.45987	10.54012	55
6	9.44297	9.98262	9.46034	10.53965	54
7	9.44341	9.98258	9.46082	10.53917	53
8	9.44384	9.98255	9.46129	10.53870	52
9	9.44428	9.98251	9.46176	10.53823	51
10	9.44471	9.98247	9.46224	10.53775	50
11	9.44515	9.98244	9.46271	10.53728	49
12	9.44559	9.98240	9.46318	10.53681	48
13	9.44602	9.98236	9.46365	10.53634	47
14	9.44645	9.98233	9.46412	10.53587	46
15	9.44689	9.98229	9.46459	10.53540	45
16	9.44732	9.98225	9.46506	10.53493	44
17	9.44775	9.98222	9.46553	10.53446	43
18	9.44819	9.98218	9.46600	10.53399	42
19	9.44862	9.98214	9.46647	10.53352	41
20	9.44905	9.98210	9.46694	10.53305	40
21	9.44948	9.98207	9.46741	10.53258	39
22	9.44991	9.98203	9.46788	10.53211	38
23	9.45034	9.98199	9.46834	10.53165	37
24	9.45077	9.98196	9.46881	10.53118	36
25	9.45120	9.98192	9.46928	10.53071	35
26	9.45163	9.98188	9.46974	10.53025	34
27	9.45206	9.98184	9.47021	10.52978	33
28	9.45248	9.98181	9.47067	10.52932	32
29	9.45291	9.98177	9.47114	10.52885	31
30	9.45334	9.98173	9.47160	10.52839	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
	106			73 Degrees.	

Min.	16 Degrees.				163
	Sine.	Cofine.	Tangent.	Cotang.	
30	9.45334	9.98173	9.47160	10.52839	30
31	9.45376	9.98169	9.47206	10.52793	29
32	9.45419	9.98166	9.47253	10.52746	28
33	9.45461	9.98162	9.47299	10.52700	27
34	9.45504	9.98158	9.47345	10.52654	26
35	9.45546	9.98154	9.47391	10.52608	25
36	9.45589	9.98151	9.47438	10.52561	24
37	9.45631	9.98147	9.47484	10.52515	23
38	9.45673	9.98143	9.47530	10.52469	22
39	9.45716	9.98139	9.47576	10.52423	21
40	9.45758	9.98136	9.47622	10.52377	20
41	9.45800	9.98132	9.47668	10.52331	19
42	9.45842	9.98128	9.47714	10.52285	18
43	9.45884	9.98124	9.47760	10.52239	17
44	9.45926	9.98120	9.47805	10.52194	16
45	9.45968	9.98117	9.47851	10.52148	15
46	9.46010	9.98113	9.47897	10.52102	14
47	9.46052	9.98109	9.47943	10.52056	13
48	9.46094	9.98105	9.47988	10.52011	12
49	9.46136	9.98101	9.48034	10.51965	11
50	9.46178	9.98098	9.48080	10.51919	10
51	9.46219	9.98094	9.48125	10.51874	9
52	9.46261	9.98090	9.48171	10.51828	8
53	9.46303	9.98086	9.48216	10.51783	7
54	9.46344	9.98082	9.48262	10.51737	6
55	9.46386	9.98078	9.48307	10.51692	5
56	9.46427	9.98075	9.48352	10.51647	4
57	9.46469	9.98071	9.48398	10.51601	3
58	9.46510	9.98067	9.48443	10.51556	2
59	9.46552	9.98063	9.48488	10.51511	1
60	9.46593	9.98059	9.48533	10.51466	0
	Cofine.	Sine.	Cotang.	Tangent.	Σ
106					73 Degrees.

Min.	17 Degrees.				162
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.46593	9.98059	9.48533	10.51466	60
1	9.46634	9.98055	9.48579	10.51420	59
2	9.46676	9.98051	9.48624	10.51375	58
3	9.46717	9.98048	9.48669	10.51330	57
4	9.46758	9.98044	9.48714	10.51285	56
5	9.46799	9.98040	9.48759	10.51240	55
6	9.46840	9.98036	9.48804	10.51195	54
7	9.46881	9.98032	9.48849	10.51150	53
8	9.46922	9.98028	9.48894	10.51105	52
9	9.46963	9.98024	9.48938	10.51061	51
10	9.47004	9.98020	9.48983	10.51016	50
11	9.47045	9.98016	9.49028	10.50971	49
12	9.47086	9.98012	9.49073	10.50926	48
13	9.47127	9.98009	9.49118	10.50881	47
14	9.47167	9.98005	9.49162	10.50837	46
15	9.47208	9.98001	9.49207	10.50792	45
16	9.47249	9.97997	9.49251	10.50748	44
17	9.47289	9.97993	9.49296	10.50703	43
18	9.47330	9.97989	9.49340	10.50659	42
19	9.47370	9.97985	9.49385	10.50614	41
20	9.47411	9.97981	9.49429	10.50570	40
21	9.47451	9.97977	9.49474	10.50525	39
22	9.47492	9.97973	9.49518	10.50481	38
23	9.47532	9.97969	9.49562	10.50437	37
24	9.47573	9.97965	9.49607	10.50392	36
25	9.47613	9.97961	9.49651	10.50348	35
26	9.47653	9.97957	9.49695	10.50304	34
27	9.47693	9.97953	9.49739	10.50260	33
28	9.47733	9.97949	9.49784	10.50215	32
29	9.47774	9.97945	9.49828	10.50171	31
30	9.47814	9.97941	9.49872	10.50127	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
107					72 Degrees.

Min.	17 Degrees.				162
	Sine.	Cofine.	Tangent.	Cotang.	
30	9.47814	9.97941	9.49872	10.50127	30
31	9.47854	9.97937	9.49916	10.50083	29
32	9.47894	9.97933	9.49960	10.50039	28
33	9.47934	9.97929	9.50004	10.49995	27
34	9.47974	9.97925	9.50048	10.49951	26
35	9.48014	9.97921	9.50092	10.49907	25
36	9.48053	9.97917	9.50135	10.49864	24
37	9.48093	9.97913	9.50179	10.49820	23
38	9.48133	9.97909	9.50223	10.49776	22
39	9.48173	9.97905	9.50267	10.49732	21
40	9.48212	9.97901	9.50310	10.49689	20
41	9.48252	9.97897	9.50354	10.49645	19
42	9.48292	9.97893	9.50398	10.49601	18
43	9.48331	9.97889	9.50441	10.49558	17
44	9.48371	9.97885	9.50485	10.49514	16
45	9.48410	9.97881	9.50528	10.49471	15
46	9.48450	9.97877	9.50572	10.49427	14
47	9.48489	9.97873	9.50615	10.49384	13
48	9.48528	9.97869	9.50659	10.49340	12
49	9.48568	9.97865	9.50702	10.49297	11
50	9.48607	9.97861	9.50746	10.49253	10
51	9.48646	9.97857	9.50789	10.49210	9
52	9.48685	9.97853	9.50832	10.49167	8
53	9.48725	9.97849	9.50875	10.49124	7
54	9.48764	9.97845	9.50919	10.49080	6
55	9.48803	9.97841	9.50962	10.49037	5
56	9.48842	9.97837	9.51005	10.48994	4
57	9.48881	9.97832	9.51048	10.48951	3
58	9.48920	9.97828	9.51091	10.48908	2
59	9.48959	9.97824	9.51134	10.48865	1
60	9.48998	9.97820	9.51177	10.48822	0
	Cofine.	Sine.	Cotang.	Tangent.	Σ
107					72 Degrees.

Min.	18 Degrees.				161
	Sine	Cofine.	Tangent.	Cotang.	
0	9.48998	9.97820	9.51177	10.48822	60
1	9.49037	9.97816	9.51220	10.48779	59
2	9.49075	9.97812	9.51263	10.48736	58
3	9.49114	9.97808	9.51306	10.48693	57
4	9.49153	9.97804	9.51349	10.48650	56
5	9.49192	9.97800	9.51392	10.48607	55
6	9.49230	9.97795	9.51434	10.48565	54
7	9.49269	9.97791	9.51477	10.48522	53
8	9.49308	9.97787	9.51520	10.48479	52
9	9.49346	9.97783	9.51563	10.48436	51
10	9.49385	9.97779	9.51605	10.48394	50
11	9.49423	9.97775	9.51648	10.48351	49
12	9.49462	9.97771	9.51690	10.48309	48
13	9.49500	9.97766	9.51733	10.48266	47
14	9.49538	9.97762	9.51776	10.48223	46
15	9.49577	9.97758	9.51818	10.48181	45
16	9.49615	9.97754	9.51861	10.48138	44
17	9.49653	9.97750	9.51903	10.48096	43
18	9.49691	9.97746	9.51945	10.48054	42
19	9.49730	9.97741	9.51988	10.48011	41
20	9.49768	9.97737	9.52030	10.47969	40
21	9.49806	9.97733	9.52072	10.47927	39
22	9.49844	9.97729	9.52115	10.47884	38
23	9.49882	9.97725	9.52157	10.47842	37
24	9.49920	9.97720	9.52199	10.47800	36
25	9.49958	9.97716	9.52241	10.47758	35
26	9.49996	9.97712	9.52283	10.47716	34
27	9.50034	9.97708	9.52325	10.47674	33
28	9.50072	9.97704	9.52367	10.47632	32
29	9.50109	9.97699	9.52409	10.47590	31
30	9.50147	9.97695	9.52451	10.47548	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
108					71 Degrees.

Min.	18 Degrees.				161
	Sine.	Cofine.	Tangent.	Cotang.	
30	9.50147	9.97695	9.52451	10.47548	30
31	9.50185	9.97691	9.52473	10.47506	29
32	9.50223	9.97687	9.52535	10.47464	28
33	9.50260	9.97682	9.52577	10.47422	27
34	9.50298	9.97678	9.52619	10.47380	26
35	9.50335	9.97674	9.52661	10.47338	25
36	9.50373	9.97670	9.52703	10.47296	24
37	9.50411	9.97665	9.52745	10.47254	23
38	9.50448	9.97661	9.52786	10.47213	22
39	9.50485	9.97657	9.52828	10.47171	21
40	9.50523	9.97653	9.52870	10.47129	20
41	9.50560	9.97648	9.52911	10.47088	19
42	9.50598	9.97644	9.52953	10.47046	18
43	9.50635	9.97640	9.52995	10.47004	17
44	9.50672	9.97636	9.53036	10.46963	16
45	9.50709	9.97631	9.53078	10.46921	15
46	9.50747	9.97627	9.53119	10.46880	14
47	9.50784	9.97623	9.53161	10.46838	13
48	9.50821	9.97618	9.53202	10.46797	12
49	9.50858	9.97614	9.53243	10.46756	11
50	9.50895	9.97610	9.53285	10.46714	10
51	9.50932	9.97605	9.53326	10.46673	9
52	9.50969	9.97601	9.53367	10.46632	8
53	9.51006	9.97597	9.53409	10.46590	7
54	9.51043	9.97593	9.53450	10.46549	6
55	9.51080	9.97588	9.53491	10.46508	5
56	9.51117	9.97584	9.53532	10.46467	4
57	9.51153	9.97580	9.53573	10.46426	3
58	9.51190	9.97575	9.53615	10.46384	2
59	9.51227	9.97571	9.53656	10.46343	1
60	9.51264	9.97567	9.53697	10.46302	0
	Cofine.	Sine.	Cotang.	Tangent.	Σ
108					71 Degrees.

Min.	19 Degrees.				160
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.51264	9.97567	9.53697	10.46302	60
1	9.51300	9.97562	9.53738	10.46261	59
2	9.51337	9.97558	9.53779	10.46220	58
3	9.51374	9.97553	9.53820	10.46179	57
4	9.51410	9.97549	9.53861	10.46138	56
5	9.51447	9.97545	9.53902	10.46098	55
6	9.51483	9.97540	9.53942	10.46057	54
7	9.51520	9.97536	9.53983	10.46016	53
8	9.51556	9.97532	9.54024	10.45975	52
9	9.51593	9.97527	9.54065	10.45934	51
10	9.51629	9.97523	9.54106	10.45893	50
11	9.51665	9.97518	9.54146	10.45853	49
12	9.51701	9.97514	9.54187	10.45812	48
13	9.51738	9.97510	9.54228	10.45771	47
14	9.51774	9.97505	9.54268	10.45731	46
15	9.51810	9.97501	9.54309	10.45690	45
16	9.51846	9.97496	9.54349	10.45650	44
17	9.51882	9.97492	9.54390	10.45609	43
18	9.51919	9.97488	9.54431	10.45569	42
19	9.51955	9.97483	9.54471	10.45528	41
20	9.51991	9.97479	9.54511	10.45488	40
21	9.52027	9.97474	9.54552	10.45447	39
22	9.52063	9.97470	9.54592	10.45407	38
23	9.52098	9.97465	9.54633	10.45366	37
24	9.52134	9.97461	9.54673	10.45326	36
25	9.52170	9.97456	9.54713	10.45286	35
26	9.52206	9.97452	9.54754	10.45245	34
27	9.52242	9.97448	9.54794	10.45205	33
28	9.52278	9.97443	9.54834	10.45165	32
29	9.52313	9.97439	9.54874	10.45125	31
30	9.52349	9.97434	9.54914	10.45085	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
109					70 Degrees.

Min.	19 Degrees.				160
	Sine.	Cofine.	Tangent.	Cotang.	
30	9.52349	9.97434	9.54914	10.45085	30
31	9.52385	9.97430	9.54955	10.45045	29
32	9.52420	9.97425	9.54995	10.45004	28
33	9.52456	9.97421	9.55035	10.44964	27
34	9.52491	9.97416	9.55075	10.44924	26
35	9.52527	9.97412	9.55115	10.44884	25
36	9.52562	9.97407	9.55155	10.44844	24
37	9.52598	9.97403	9.55195	10.44804	23
38	9.52633	9.97398	9.55235	10.44764	22
39	9.52669	9.97394	9.55275	10.44724	21
40	9.52704	9.97389	9.55314	10.44685	20
41	9.52739	9.97385	9.55354	10.44645	19
42	9.52775	9.97380	9.55394	10.44605	18
43	9.52810	9.97376	9.55434	10.44565	17
44	9.52845	9.97371	9.55474	10.44525	16
45	9.52880	9.97367	9.55513	10.44486	15
46	9.52916	9.97362	9.55553	10.44446	14
47	9.52951	9.97358	9.55593	10.44406	13
48	9.52986	9.97353	9.55632	10.44367	12
49	9.53021	9.97348	9.55672	10.44327	11
50	9.53056	9.97344	9.55712	10.44287	10
51	9.53091	9.97339	9.55751	10.44248	9
52	9.53126	9.97335	9.55791	10.44208	8
53	9.53161	9.97330	9.55830	10.44169	7
54	9.53196	9.97326	9.55870	10.44129	6
55	9.53231	9.97321	9.55909	10.44090	5
56	9.53266	9.97316	9.55949	10.44050	4
57	9.53300	9.97312	9.55988	10.44011	3
58	9.53335	9.97307	9.56027	10.43972	2
59	9.53370	9.97303	9.56067	10.43932	1
60	9.53405	9.97298	9.56106	10.43893	0
	Cofine.	Sine.	Cotang.	Tangent.	N
109					70 Degrees.

Min.	20 Degrees.				159
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.53405	9.97298	9.56106	10.43893	60
1	9.53439	9.97293	9.56145	10.43854	59
2	9.53474	9.97289	9.56185	10.43814	58
3	9.53509	9.97284	9.56224	10.43775	57
4	9.53543	9.97280	9.56263	10.43736	56
5	9.53578	9.97275	9.56302	10.43697	55
6	9.53612	9.97270	9.56341	10.43658	54
7	9.53647	9.97266	9.56381	10.43618	53
8	9.53681	9.97261	9.56420	10.43579	52
9	9.53716	9.97257	9.56459	10.43540	51
10	9.53750	9.97252	9.56498	10.43501	50
11	9.53785	9.97247	9.56537	10.43462	49
12	9.53819	9.97243	9.56576	10.43423	48
13	9.53853	9.97238	9.56615	10.43384	47
14	9.53888	9.97233	9.56654	10.43345	46
15	9.53922	9.97229	9.56693	10.43306	45
16	9.53956	9.97224	9.56732	10.43267	44
17	9.53990	9.97219	9.56770	10.43229	43
18	9.54024	9.97215	9.56809	10.43190	42
19	9.54059	9.97210	9.56848	10.43151	41
20	9.54093	9.97205	9.56887	10.43112	40
21	9.54127	9.97201	9.56926	10.43073	39
22	9.54161	9.97196	9.56964	10.43035	38
23	9.54195	9.97191	9.57003	10.42996	37
24	9.54229	9.97187	9.57042	10.42957	36
25	9.54263	9.97182	9.57080	10.42919	35
26	9.54297	9.97177	9.57119	10.42880	34
27	9.54331	9.97172	9.57158	10.42841	33
28	9.54364	9.97168	9.57196	10.42803	32
29	9.54398	9.97163	9.57235	10.42764	31
30	9.54432	9.97158	9.57273	10.42726	30
	C. sine.	Sine.	Cotang.	Tangent.	M
110					69 Degrees.

20 Degrees.					159
Min.	Sine.	Cofine.	Tangent.	Cotang.	
30	9.54432	9.97158	9.57273	10.42726	30
31	9.54466	9.97154	9.57312	10.42687	29
32	9.54500	9.97149	9.57350	10.42649	28
33	9.54533	9.97144	9.57389	10.42610	27
34	9.54567	9.97139	9.57427	10.42572	26
35	9.54601	9.97135	9.57466	10.42533	25
36	9.54634	9.97130	9.57504	10.42495	24
37	9.54668	9.97125	9.57542	10.42457	23
38	9.54701	9.97120	9.57581	10.42418	22
39	9.54735	9.97116	9.57619	10.42380	21
40	9.54768	9.97111	9.57657	10.42342	20
41	9.54802	9.97106	9.57695	10.42304	19
42	9.54835	9.97101	9.57734	10.42265	18
43	9.54869	9.97097	9.57772	10.42227	17
44	9.54902	9.97092	9.57810	10.42189	16
45	9.54936	9.97087	9.57848	10.42151	15
46	9.54969	9.97082	9.57886	10.42113	14
47	9.55002	9.97077	9.57924	10.42075	13
48	9.55035	9.97073	9.57962	10.42037	12
49	9.55069	9.97068	9.58000	10.41999	11
50	9.55102	9.97063	9.58038	10.41961	10
51	9.55135	9.97058	9.58076	10.41923	9
52	9.55168	9.97053	9.58114	10.41885	8
53	9.55201	9.97049	9.58152	10.41847	7
54	9.55234	9.97044	9.58190	10.41809	6
55	9.55268	9.97039	9.58228	10.41771	5
56	9.55301	9.97034	9.58266	10.41733	4
57	9.55334	9.97029	9.58304	10.41695	3
58	9.55367	9.97024	9.58342	10.41657	2
59	9.55399	9.97020	9.58379	10.41620	1
60	9.55432	9.97015	9.58417	10.41582	0
	Cofine.	Sine.	Cotang.	Tangent.	N
110	69 Degrees.				

Min.	21 Degrees.				158
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.55432	9.97015	9.58417	10.41582	60
1	9.55465	9.97010	9.58455	10.41544	59
2	9.55498	9.97005	9.58493	10.41506	58
3	9.55531	9.97000	9.58530	10.41469	57
4	9.55564	9.96995	9.58568	10.41431	56
5	9.55597	9.96990	9.58606	10.41393	55
6	9.55629	9.96986	9.58643	10.41356	54
7	9.55662	9.96981	9.58681	10.41318	53
8	9.55695	9.96976	9.58719	10.41280	52
9	9.55727	9.96971	9.58756	10.41243	51
10	9.55760	9.96966	9.58794	10.41205	50
11	9.55793	9.96961	9.58831	10.41168	49
12	9.55825	9.96956	9.58869	10.41130	48
13	9.55858	9.96951	9.58906	10.41093	47
14	9.55890	9.96946	9.58944	10.41055	46
15	9.55923	9.96941	9.58981	10.41018	45
16	9.55955	9.96937	9.59018	10.40981	44
17	9.55988	9.96932	9.59056	10.40943	43
18	9.56020	9.96927	9.59093	10.40906	42
19	9.56053	9.96922	9.59130	10.40869	41
20	9.56085	9.96917	9.59168	10.40831	40
21	9.56117	9.96912	9.59205	10.40794	39
22	9.56150	9.96907	9.59242	10.40757	38
23	9.56182	9.96902	9.59279	10.40720	37
24	9.56214	9.96897	9.59317	10.40682	36
25	9.56246	9.96892	9.59354	10.40645	35
26	9.56279	9.96887	9.59391	10.40608	34
27	9.56311	9.96882	9.59428	10.40571	33
28	9.56343	9.96877	9.59465	10.40534	32
29	9.56375	9.96872	9.59502	10.40497	31
30	9.56407	9.96867	9.59539	10.40460	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
111					68 Degrees.

Min.	21 Degrees.				158
	Sine.	Cofine.	Tangent.	Cotang.	
30	9.56407	9.96867	9.59539	10.40460	30
31	9.56439	9.96852	9.59576	10.40423	29
32	9.56471	9.96857	9.59613	10.40386	28
33	9.56503	9.96852	9.59650	10.40349	27
34	9.56535	9.96847	9.59687	10.40312	26
35	9.56567	9.96842	9.59724	10.40275	25
36	9.56599	9.96837	9.59761	10.40238	24
37	9.56631	9.96832	9.59798	10.40201	23
38	9.56663	9.96827	9.59835	10.40164	22
39	9.56695	9.96822	9.59872	10.40127	21
40	9.56726	9.96817	9.59909	10.40090	20
41	9.56758	9.96812	9.59945	10.40054	19
42	9.56790	9.96807	9.59982	10.40017	18
43	9.56822	9.96802	9.60019	10.39980	17
44	9.56853	9.96797	9.60056	10.39943	16
45	9.56885	9.96792	9.60092	10.39907	15
46	9.56917	9.96787	9.60129	10.39870	14
47	9.56948	9.96782	9.60166	10.39833	13
48	9.56980	9.96777	9.60202	10.39797	12
49	9.57012	9.96772	9.60239	10.39760	11
50	9.57043	9.96767	9.60276	10.39723	10
51	9.57075	9.96762	9.60312	10.39687	9
52	9.57106	9.96757	9.60349	10.39650	8
53	9.57138	9.96752	9.60385	10.39614	7
54	9.57169	9.96747	9.60422	10.39577	6
55	9.57200	9.96742	9.60458	10.39541	5
56	9.57232	9.96736	9.60495	10.39504	4
57	9.57263	9.96731	9.60531	10.39468	3
58	9.57294	9.96726	9.60568	10.39431	2
59	9.57326	9.96721	9.60604	10.39395	1
60	9.57357	9.96716	9.60640	10.39359	0
	Cofine.	Sine.	Cotang.	Tangent.	Σ

Min.	22 Degrees.				157
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.57357	9.96716	9.60640	10.39359	60
1	9.57388	9.96711	9.60677	10.39322	59
2	9.57420	9.96706	9.60713	10.39286	58
3	9.57451	9.96701	9.60749	10.39250	57
4	9.57482	9.96696	9.60786	10.39213	56
5	9.57513	9.96691	9.60822	10.39177	55
6	9.57544	9.96685	9.60858	10.39141	54
7	9.57575	9.96680	9.60895	10.39104	53
8	9.57606	9.96675	9.60931	10.39068	52
9	9.57637	9.96670	9.60967	10.39032	51
10	9.57668	9.96665	9.61003	10.38996	50
11	9.57699	9.96660	9.61039	10.38960	49
12	9.57730	9.96655	9.61075	10.38924	48
13	9.57761	9.96649	9.61111	10.38888	47
14	9.57792	9.96644	9.61148	10.38851	46
15	9.57823	9.96639	9.61184	10.38815	45
16	9.57854	9.96634	9.61220	10.38779	44
17	9.57885	9.96629	9.61256	10.38743	43
18	9.57916	9.96624	9.61292	10.38707	42
19	9.57946	9.96618	9.61328	10.38671	41
20	9.57977	9.96613	9.61364	10.38635	40
21	9.58008	9.96608	9.61400	10.38600	39
22	9.58039	9.96603	9.61435	10.38564	38
23	9.58069	9.96598	9.61471	10.38528	37
24	9.58100	9.96592	9.61507	10.38492	36
25	9.58131	9.96587	9.61543	10.38456	35
26	9.58161	9.96582	9.61579	10.38420	34
27	9.58192	9.96577	9.61615	10.38384	33
28	9.58222	9.96571	9.61650	10.38349	32
29	9.58253	9.96566	9.61686	10.38313	31
30	9.58283	9.96561	9.61722	10.38277	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ

Min.	22 Degrees.				157	
	Sine.	Cofine.	Tangent.	Cotang.		
30	9.58283	9.96561	9.61722	10.38277	30	
31	9.58314	9.96556	9.61758	10.38241	29	
32	9.58344	9.96551	9.61793	10.38206	28	
33	9.58375	9.96545	9.61829	10.38170	27	
34	9.58405	9.96540	9.61865	10.38134	26	
35	9.58436	9.96535	9.61900	10.38099	25	
36	9.58466	9.96530	9.61936	10.38063	24	
37	9.58496	9.96524	9.61972	10.38027	23	
38	9.58527	9.96519	9.62007	10.37992	22	
39	9.58557	9.96514	9.62043	10.37956	21	
40	9.58587	9.96508	9.62078	10.37921	20	
41	9.58617	9.96503	9.62114	10.37885	19	
42	9.58648	9.96498	9.62149	10.37850	18	
43	9.58678	9.96493	9.62185	10.37814	17	
44	9.58708	9.96487	9.62220	10.37779	16	
45	9.58738	9.96482	9.62256	10.37743	15	
46	9.58768	9.96477	9.62291	10.37708	14	
47	9.58798	9.96471	9.62326	10.37673	13	
48	9.58828	9.96466	9.62362	10.37637	12	
49	9.58858	9.96461	9.62397	10.37602	11	
50	9.58888	9.96456	9.62432	10.37567	10	
51	9.58918	9.96450	9.62468	10.37531	9	
52	9.58948	9.96445	9.62503	10.37496	8	
53	9.58978	9.96440	9.62538	10.37461	7	
54	9.59008	9.96434	9.62574	10.37425	6	
55	9.59038	9.96429	9.62609	10.37390	5	
56	9.59068	9.96424	9.62644	10.37355	4	
57	9.59098	9.96418	9.62679	10.37320	3	
58	9.59128	9.96413	9.62714	10.37285	2	
59	9.59158	9.96407	9.62750	10.37249	1	
60	9.59187	9.96402	9.62785	10.37214	0	
	Cofine.	Sine.	Cotang.	Tangent.	N	

Min.	23 Degrees.				156
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.59187	9.96402	9.62785	10.37214	60
1	9.59217	9.96397	9.62820	10.37179	59
2	9.59247	9.96391	9.62855	10.37144	58
3	9.59276	9.96386	9.62890	10.37109	57
4	9.59306	9.96381	9.62925	10.37074	56
5	9.59336	9.96375	9.62960	10.37039	55
6	9.59365	9.96370	9.62995	10.37004	54
7	9.59395	9.96364	9.63030	10.36969	53
8	9.59425	9.96359	9.63065	10.36934	52
9	9.59454	9.96354	9.63100	10.36899	51
10	9.59484	9.96348	9.63135	10.36864	50
11	9.59513	9.96343	9.63170	10.36829	49
12	9.59543	9.96337	9.63205	10.36794	48
13	9.59572	9.96332	9.63240	10.36759	47
14	9.59602	9.96327	9.63275	10.36724	46
15	9.59631	9.96321	9.63309	10.36690	45
16	9.59660	9.96316	9.63344	10.36655	44
17	9.59690	9.96310	9.63379	10.36620	43
18	9.59719	9.96305	9.63414	10.36585	42
19	9.59748	9.96299	9.63449	10.36550	41
20	9.59778	9.96294	9.63483	10.36516	40
21	9.59807	9.96289	9.63518	10.36481	39
22	9.59836	9.96283	9.63553	10.36446	38
23	9.59866	9.96278	9.63587	10.36412	37
24	9.59895	9.96272	9.63622	10.36377	36
25	9.59924	9.96267	9.63657	10.36342	35
26	9.59953	9.96261	9.63691	10.36308	34
27	9.59982	9.96256	9.63726	10.36273	33
28	9.60011	9.96250	9.63761	10.36238	32
29	9.60040	9.96245	9.63795	10.36204	31
30	9.60069	9.96239	9.63830	10.36169	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
113					66 Degrees.

Min.	23 Degrees.				156
	Sine.	Cofine.	Tangent.	Cotang.	
30	9.60069	9.96239	9.63830	10.36169	30
31	9.60099	9.96234	9.63864	10.36135	29
32	9.60128	9.96228	9.63899	10.36100	28
33	9.60157	9.96223	9.63933	10.36066	27
34	9.60186	9.96217	9.63968	10.36031	26
35	9.60214	9.96212	9.64002	10.35997	25
36	9.60243	9.96206	9.64037	10.35962	24
37	9.60272	9.96201	9.64071	10.35928	23
38	9.60301	9.96195	9.64105	10.35894	22
39	9.60330	9.96190	9.64140	10.35859	21
40	9.60359	9.96184	9.64174	10.35825	20
41	9.60388	9.96179	9.64209	10.35790	19
42	9.60416	9.96173	9.64243	10.35756	18
43	9.60445	9.96168	9.64277	10.35722	17
44	9.60474	9.96162	9.64312	10.35687	16
45	9.60503	9.96156	9.64346	10.35653	15
46	9.60531	9.96151	9.64380	10.35619	14
47	9.60560	9.96145	9.64414	10.35585	13
48	9.60589	9.96140	9.64449	10.35550	12
49	9.60617	9.96134	9.64483	10.35516	11
50	9.60646	9.96129	9.64517	10.35482	10
51	9.60675	9.96123	9.64551	10.35448	9
52	9.60703	9.96117	9.64585	10.35414	8
53	9.60732	9.96112	9.64619	10.35380	7
54	9.60760	9.96106	9.64654	10.35346	6
55	9.60789	9.96101	9.64688	10.35311	5
56	9.60817	9.96095	9.64722	10.35277	4
57	9.60846	9.96089	9.64756	10.35243	3
58	9.60874	9.96084	9.64790	10.35209	2
59	9.60902	9.96078	9.64824	10.35175	1
60	9.60931	9.96073	9.64858	10.35141	0
	Cofine.	Sine.	Cotang.	Tangent.	Σ
113					66 Degrees.

Min.	24 Degrees.				155
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.60931	9.96073	9.64858	10.35141	60
1	9.60959	9.96067	9.64892	10.35107	59
2	9.60988	9.96061	9.64926	10.35073	58
3	9.61016	9.96056	9.64960	10.35039	57
4	9.61044	9.96050	9.64994	10.35005	56
5	9.61072	9.96044	9.65028	10.34971	55
6	9.61101	9.96039	9.65061	10.34938	54
7	9.61129	9.96033	9.65095	10.34904	53
8	9.61157	9.96027	9.65129	10.34870	52
9	9.61185	9.96022	9.65163	10.34836	51
10	9.61213	9.96016	9.65197	10.34802	50
11	9.61242	9.96010	9.65231	10.34768	49
12	9.61270	9.96005	9.65265	10.34734	48
13	9.61298	9.95999	9.65298	10.34701	47
14	9.61326	9.95993	9.65332	10.34667	46
15	9.61354	9.95988	9.65366	10.34633	45
16	9.61382	9.95982	9.65400	10.34599	44
17	9.61410	9.95976	9.65433	10.34566	43
18	9.61438	9.95971	9.65467	10.34532	42
19	9.61466	9.95965	9.65501	10.34498	41
20	9.61494	9.95959	9.65534	10.34465	40
21	9.61522	9.95953	9.65568	10.34431	39
22	9.61550	9.95948	9.65602	10.34397	38
23	9.61578	9.95942	9.65635	10.34364	37
24	9.61605	9.95936	9.65669	10.34330	36
25	9.61633	9.95931	9.65702	10.34297	35
26	9.61661	9.95925	9.65736	10.34263	34
27	9.61689	9.95919	9.65769	10.34230	33
28	9.61717	9.95913	9.65803	10.34196	32
29	9.61744	9.95908	9.65836	10.34163	31
30	9.61772	9.95902	9.65870	10.34129	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ

Min.	24 Degrees.				155	
	Sine.	Cofine.	Tangent.	Cotang.		
30	9.61772	9.95902	9.65870	10.34129	30	
31	9.61800	9.95896	9.65903	10.34096	29	
32	9.61828	9.95890	9.65937	10.34062	28	
33	9.61855	9.95885	9.65970	10.34029	27	
34	9.61883	9.95879	9.66004	10.33995	26	
35	9.61911	9.95873	9.66037	10.33962	25	
36	9.61938	9.95867	9.66070	10.33929	24	
37	9.61966	9.95861	9.66104	10.33895	23	
38	9.61993	9.95856	9.66137	10.33862	22	
39	9.62021	9.95850	9.66171	10.33828	21	
40	9.62048	9.95844	9.66204	10.33795	20	
41	9.62076	9.95838	9.66237	10.33762	19	
42	9.62103	9.95832	9.66270	10.33729	18	
43	9.62131	9.95827	9.66304	10.33695	17	
44	9.62158	9.95821	9.66337	10.33662	16	
45	9.62186	9.95815	9.66370	10.33629	15	
46	9.62213	9.95809	9.66403	10.33596	14	
47	9.62240	9.95803	9.66437	10.33562	13	
48	9.62268	9.95797	9.66470	10.33529	12	
49	9.62295	9.95792	9.66503	10.33496	11	
50	9.62322	9.95786	9.66536	10.33463	10	
51	9.62350	9.95780	9.66569	10.33430	9	
52	9.62377	9.95774	9.66602	10.33397	8	
53	9.62404	9.95768	9.66635	10.33364	7	
54	9.62431	9.95762	9.66669	10.33330	6	
55	9.62459	9.95756	9.66702	10.33297	5	
56	9.62486	9.95751	9.66735	10.33264	4	
57	9.62513	9.95745	9.66768	10.33231	3	
58	9.62540	9.95739	9.66801	10.33198	2	
59	9.62567	9.95733	9.66834	10.33165	1	
60	9.62594	9.95727	9.66867	10.33132	0	
	Cofine.	Sine.	Cotang.	Tangent.	M	
114					65 Degrees.	

Min.	25 Degrees.				154
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.62594	9.95727	9.66867	10.33132	60
1	9.62621	9.95721	9.66900	10.33099	59
2	9.62648	9.95715	9.66933	10.33066	58
3	9.62676	9.95709	9.66966	10.33033	57
4	9.62703	9.95703	9.66999	10.33000	56
5	9.62730	9.95698	9.67031	10.32968	55
6	9.62757	9.95692	9.67064	10.32935	54
7	9.62783	9.95686	9.67097	10.32902	53
8	9.62810	9.95680	9.67130	10.32869	52
9	9.62837	9.95674	9.67163	10.32836	51
10	9.62864	9.95668	9.67196	10.32803	50
11	9.62891	9.95662	9.67229	10.32770	49
12	9.62918	9.95656	9.67261	10.32738	48
13	9.62945	9.95650	9.67294	10.32705	47
14	9.62972	9.95644	9.67327	10.32672	46
15	9.62998	9.95628	9.67360	10.32639	45
16	9.63025	9.95632	9.67392	10.32607	44
17	9.63052	9.95626	9.67425	10.32574	43
18	9.63079	9.95620	9.67458	10.32541	42
19	9.63105	9.95614	9.67491	10.32508	41
20	9.63132	9.95608	9.67523	10.32476	40
21	9.63159	9.95602	9.67556	10.32443	39
22	9.63185	9.95596	9.67589	10.32410	38
23	9.63212	9.95590	9.67621	10.32378	37
24	9.63239	9.95584	9.67654	10.32345	36
25	9.63265	9.95578	9.67686	10.32313	35
26	9.63292	9.95572	9.67719	10.32280	34
27	9.63318	9.95566	9.67752	10.32247	33
28	9.63345	9.95560	9.67784	10.32215	32
29	9.63371	9.95554	9.67817	10.32182	31
30	9.63398	9.95548	9.67849	10.32150	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
115					64 Degrees.

Min.	25 Degrees.				154	
	Sine.	Cofine.	Tangent.	Cotang.		
30	9.63398	9.95548	9.67849	10.32150	30	
31	9.63424	9.95542	9.67882	10.32117	29	
32	9.63451	9.95536	9.67914	10.32085	28	
33	9.63477	9.95530	9.67947	10.32052	27	
34	9.63504	9.95524	9.67979	10.32020	26	
35	9.63530	9.95518	9.68011	10.31988	25	
36	9.63556	9.95512	9.68044	10.31955	24	
37	9.63583	9.95506	9.68076	10.31923	23	
38	9.63609	9.95500	9.68109	10.31890	22	
39	9.63636	9.95494	9.68141	10.31858	21	
40	9.63662	9.95488	9.68173	10.31826	20	
41	9.63688	9.95482	9.68206	10.31793	19	
42	9.63714	9.95476	9.68238	10.31761	18	
43	9.63741	9.95470	9.68270	10.31729	17	
44	9.63767	9.95464	9.68303	10.31696	16	
45	9.63793	9.95457	9.68335	10.31664	15	
46	9.63819	9.95451	9.68367	10.31632	14	
47	9.63845	9.95445	9.68400	10.31599	13	
48	9.63871	9.95439	9.68432	10.31567	12	
49	9.63898	9.95433	9.68464	10.31535	11	
50	9.63924	9.95427	9.68496	10.31503	10	
51	9.63950	9.95421	9.68529	10.31470	9	
52	9.63976	9.95415	9.68561	10.31438	8	
53	9.64002	9.95409	9.68593	10.31406	7	
54	9.64028	9.95402	9.68625	10.31374	6	
55	9.64054	9.95396	9.68657	10.31342	5	
56	9.64080	9.95390	9.68689	10.31310	4	
57	9.64106	9.95384	9.68721	10.31278	3	
58	9.64132	9.95378	9.68754	10.31245	2	
59	9.64158	9.95372	9.68786	10.31213	1	
60	9.64184	9.95366	9.68818	10.31181	0	
	Cofine.	Sine.	Cotang.	Tangent.	N	
115					64 Degre. s.	

Min.	26 Degrees.				153
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.64184	9.95366	9.68818	10.31181	60
1	9.64210	9.95359	9.68850	10.31149	59
2	9.64235	9.95353	9.68882	10.31117	58
3	9.64261	9.95347	9.68914	10.31085	57
4	9.64287	9.95341	9.68946	10.31053	56
5	9.64313	9.95335	9.68978	10.31021	55
6	9.64339	9.95328	9.69010	10.30989	54
7	9.64365	9.95322	9.69042	10.30957	53
8	9.64390	9.95316	9.69074	10.30925	52
9	9.64416	9.95310	9.69106	10.30893	51
10	9.64442	9.95304	9.69138	10.30861	50
11	9.64467	9.95297	9.69170	10.30830	49
12	9.64493	9.95291	9.69201	10.30798	48
13	9.64519	9.95285	9.69233	10.30766	47
14	9.64544	9.95279	9.69265	10.30734	46
15	9.64570	9.95273	9.69297	10.30702	45
16	9.64596	9.95266	9.69329	10.30670	44
17	9.64621	9.95260	9.69361	10.30638	43
18	9.64647	9.95254	9.69392	10.30607	42
19	9.64672	9.95248	9.69424	10.30575	41
20	9.64698	9.95241	9.69456	10.30543	40
21	9.64723	9.95235	9.69488	10.30511	39
22	9.64749	9.95229	9.69520	10.30479	38
23	9.64774	9.95223	9.69551	10.30448	37
24	9.64800	9.95216	9.69583	10.30416	36
25	9.64825	9.95210	9.69615	10.30384	35
26	9.64851	9.95204	9.69646	10.30353	34
27	9.64876	9.95197	9.69678	10.30321	33
28	9.64902	9.95191	9.69710	10.30289	32
29	9.64927	9.95185	9.69741	10.30258	31
30	9.64952	9.95179	9.69773	10.30226	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
	116				63 Degrees.

Min.	26 Degrees.				153
	Sine.	Cofine.	Tangent.	Cotang.	
30	9.64952	9.95179	9.69773	10.30226	30
31	9.64978	9.95172	9.69805	10.30194	29
32	9.65003	9.95166	9.69836	10.30163	28
33	9.65028	9.95160	9.69868	10.30131	27
34	9.65053	9.95153	9.69900	10.30099	26
35	9.65079	9.95147	9.69931	10.30068	25
36	9.65104	9.95141	9.69963	10.30036	24
37	9.65129	9.95134	9.69994	10.30005	23
38	9.65154	9.95128	9.70026	10.29973	22
39	9.65180	9.95122	9.70057	10.29942	21
40	9.65205	9.95115	9.70089	10.29910	20
41	9.65230	9.95109	9.70120	10.29879	19
42	9.65255	9.95103	9.70152	10.29847	18
43	9.65280	9.95096	9.70183	10.29816	17
44	9.65305	9.95090	9.70215	10.29784	16
45	9.65330	9.95084	9.70246	10.29753	15
46	9.65355	9.95077	9.70278	10.29721	14
47	9.65380	9.95071	9.70309	10.29690	13
48	9.65405	9.95065	9.70340	10.29659	12
49	9.65430	9.95058	9.70372	10.29627	11
50	9.65455	9.95052	9.70403	10.29596	10
51	9.65480	9.95045	9.70434	10.29565	9
52	9.65505	9.95039	9.70466	10.29533	8
53	9.65530	9.95033	9.70497	10.29502	7
54	9.65555	9.95026	9.70528	10.29471	6
55	9.65580	9.95020	9.70560	10.29439	5
56	9.65605	9.95013	9.70591	10.29408	4
57	9.65630	9.95007	9.70622	10.29377	3
58	9.65655	9.95000	9.70654	10.29345	2
59	9.65679	9.94994	9.70685	10.29314	1
60	9.65704	9.94988	9.70716	10.29283	0
	Cofine	Sine.	Cotang.	Tangent.	N
116					63 Degrees.

27 Degrees.					152
Min.	Sine.	Cofine.	Tangent.	Cotang.	
0	9.65704	9.94988	9.70716	10.29283	60
1	9.65729	9.94981	9.70747	10.29252	59
2	9.65754	9.94975	9.70779	10.29220	58
3	9.65778	9.94968	9.70810	10.29189	57
4	9.65803	9.94962	9.70841	10.29158	56
5	9.65828	9.94955	9.70872	10.29127	55
6	9.65853	9.94949	9.70903	10.29096	54
7	9.65877	9.94942	9.70934	10.29065	53
8	9.65902	9.94936	9.70966	10.29033	52
9	9.65927	9.94929	9.70997	10.29002	51
10	9.65951	9.94923	9.71028	10.28971	50
11	9.65976	9.94917	9.71059	10.28940	49
12	9.66000	9.94910	9.71090	10.28909	48
13	9.66025	9.94904	9.71121	10.28878	47
14	9.66050	9.94897	9.71152	10.28847	46
15	9.66074	9.94891	9.71183	10.28816	45
16	9.66099	9.94884	9.71214	10.28785	44
17	9.66123	9.94877	9.71245	10.28754	43
18	9.66148	9.94871	9.71276	10.28723	42
19	9.66172	9.94864	9.71307	10.28692	41
20	9.66197	9.94858	9.71338	10.28661	40
21	9.66221	9.94851	9.71369	10.28630	39
22	9.66245	9.94845	9.71400	10.28599	38
23	9.66270	9.94838	9.71431	10.28568	37
24	9.66294	9.94832	9.71462	10.28537	36
25	9.66319	9.94825	9.71493	10.28506	35
26	9.66343	9.94819	9.71524	10.28475	34
27	9.66367	9.94812	9.71555	10.28444	33
28	9.66391	9.94806	9.71585	10.28414	32
29	9.66416	9.94799	9.71616	10.28383	31
30	9.66440	9.94792	9.71647	10.28352	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
117	62 Degrees.				

Min.	27 Degrees.				152
	Sine.	Cofine.	Tangent.	Cotang.	
30	9.66440	9.94792	9.71647	10.28352	30
31	9.66464	9.94786	9.71678	10.28321	29
32	9.66489	9.94779	9.71709	10.28290	28
33	9.66513	9.94773	9.71740	10.28259	27
34	9.66537	9.94766	9.71770	10.28229	26
35	9.66561	9.94759	9.71801	10.28198	25
36	9.66585	9.94753	9.71832	10.28167	24
37	9.66610	9.94746	9.71863	10.28136	23
38	9.66634	9.94740	9.71894	10.28105	22
39	9.66658	9.94733	9.71924	10.28075	21
40	9.66682	9.94726	9.71955	10.28044	20
41	9.66706	9.94720	9.71986	10.28013	19
42	9.66730	9.94713	9.72016	10.27983	18
43	9.66754	9.94707	9.72047	10.27952	17
44	9.66778	9.94700	9.72078	10.27921	16
45	9.66802	9.94693	9.72108	10.27891	15
46	9.66826	9.94687	9.72139	10.27860	14
47	9.66850	9.94680	9.72170	10.27829	13
48	9.66874	9.94673	9.72200	10.27799	12
49	9.66898	9.94667	9.72231	10.27768	11
50	9.66922	9.94660	9.72262	10.27737	10
51	9.66946	9.94653	9.72292	10.27707	9
52	9.66970	9.94647	9.72323	10.27676	8
53	9.66994	9.94640	9.72353	10.27646	7
54	9.67018	9.94633	9.72384	10.27615	6
55	9.67041	9.94627	9.72414	10.27585	5
56	9.67065	9.94620	9.72445	10.27554	4
57	9.67089	9.94613	9.72475	10.27524	3
58	9.67113	9.94606	9.72506	10.27493	2
59	9.67137	9.94600	9.72536	10.27463	1
60	9.67160	9.94593	9.72567	10.27432	0
	Cofine.	Sine.	Cotang.	Tangent.	Σ

117

62 Degrees.

Min.	28 Degrees.				151
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.67160	9.94593	9.72567	10.27432	60
1	9.67184	9.94586	9.72597	10.27402	59
2	9.67208	9.94580	9.72628	10.27371	58
3	9.67232	9.94573	9.72658	10.27341	57
4	9.67255	9.94566	9.72689	10.27310	56
5	9.67279	9.94559	9.72719	10.27280	55
6	9.67303	9.94553	9.72750	10.27249	54
7	9.67326	9.94546	9.72780	10.27219	53
8	9.67350	9.94539	9.72810	10.27189	52
9	9.67374	9.94532	9.72841	10.27158	51
10	9.67397	9.94526	9.72871	10.27128	50
11	9.67421	9.94519	9.72901	10.27098	49
12	9.67444	9.94512	9.72932	10.27067	48
13	9.67468	9.94505	9.72962	10.27037	47
14	9.67491	9.94498	9.72992	10.27007	46
15	9.67515	9.94492	9.73023	10.26976	45
16	9.67538	9.94485	9.73053	10.26946	44
17	9.67562	9.94478	9.73083	10.26916	43
18	9.67585	9.94471	9.73114	10.26885	42
19	9.67609	9.94465	9.73144	10.26855	41
20	9.67632	9.94458	9.73174	10.26825	40
21	9.67656	9.94451	9.73204	10.26795	39
22	9.67679	9.94444	9.73235	10.26764	38
23	9.67703	9.94437	9.73265	10.26734	37
24	9.67726	9.94430	9.73295	10.26704	36
25	9.67749	9.94424	9.73325	10.26674	35
26	9.67773	9.94417	9.73355	10.26644	34
27	9.67796	9.94410	9.73386	10.26613	33
28	9.67819	9.94403	9.73416	10.26583	32
29	9.67843	9.94396	9.73446	10.26553	31
30	9.67866	9.94389	9.73476	10.26523	30
	Cofine.	Sine.	Cotang.	Tangent.	N
118					61 Degrees.

Min.	28 Degrees.				151
	Sine.	Cofine.	Tangent.	Cotang.	
30	9.67866	9.94389	9.73476	10.26523	30
31	9.67889	9.94382	9.73506	10.26493	29
32	9.67912	9.94376	9.73536	10.26463	28
33	9.67936	9.94369	9.73566	10.26433	27
34	9.67959	9.94362	9.73596	10.26403	26
35	9.67982	9.94355	9.73626	10.26373	25
36	9.68005	9.94348	9.73656	10.26343	24
37	9.68028	9.94341	9.73687	10.26312	23
38	9.68051	9.94334	9.73717	10.26282	22
39	9.68075	9.94327	9.73747	10.26252	21
40	9.68098	9.94321	9.73777	10.26222	20
41	9.68121	9.94314	9.73807	10.26192	19
42	9.68144	9.94307	9.73837	10.26162	18
43	9.68167	9.94300	9.73867	10.26132	17
44	9.68190	9.94293	9.73897	10.26102	16
45	9.68213	9.94286	9.73927	10.26072	15
46	9.68236	9.94279	9.73957	10.26042	14
47	9.68259	9.94272	9.73986	10.26013	13
48	9.68282	9.94265	9.74016	10.25983	12
49	9.68305	9.94258	9.74046	10.25953	11
50	9.68328	9.94251	9.74076	10.25923	10
51	9.68351	9.94244	9.74106	10.25893	9
52	9.68374	9.94237	9.74136	10.25863	8
53	9.68397	9.94230	9.74166	10.25833	7
54	9.68420	9.94223	9.74196	10.25803	6
55	9.68442	9.94216	9.74226	10.25773	5
56	9.68465	9.94209	9.74255	10.25744	4
57	9.68488	9.94202	9.74285	10.25714	3
58	9.68511	9.94195	9.74315	10.25684	2
59	9.68534	9.94188	9.74345	10.25654	1
60	9.68557	9.94181	9.74375	10.25624	0
	Cofine.	Sine.	Cotang.	Tangent.	M
118					61 Degrees.

Min.	29 Degrees.				150
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.68557	9.94181	9.74375	10.25624	60
1	9.68579	9.94174	9.74404	10.25595	59
2	9.68602	9.94167	9.74434	10.25565	58
3	9.68625	9.94160	9.74464	10.25535	57
4	9.68648	9.94153	9.74494	10.25505	56
5	9.68670	9.94146	9.74524	10.25475	55
6	9.68693	9.94139	9.74553	10.25446	54
7	9.68716	9.94132	9.74583	10.25416	53
8	9.68738	9.94125	9.74613	10.25386	52
9	9.68761	9.94118	9.74642	10.25357	51
10	9.68784	9.94111	9.74672	10.25327	50
11	9.68806	9.94104	9.74702	10.25297	49
12	9.68829	9.94097	9.74731	10.25268	48
13	9.68852	9.94090	9.74761	10.25238	47
14	9.68874	9.94083	9.74791	10.25208	46
15	9.68897	9.94076	9.74820	10.25179	45
16	9.68919	9.94069	9.74850	10.25149	44
17	9.68942	9.94062	9.74880	10.25119	43
18	9.68964	9.94055	9.74909	10.25090	42
19	9.68987	9.94048	9.74939	10.25060	41
20	9.69009	9.94040	9.74968	10.25031	40
21	9.69032	9.94033	9.74998	10.25001	39
22	9.69054	9.94026	9.75028	10.24971	38
23	9.69077	9.94019	9.75057	10.24942	37
24	9.69099	9.94012	9.75087	10.24912	36
25	9.69122	9.94005	9.75116	10.24883	35
26	9.69144	9.93998	9.75146	10.24853	34
27	9.69166	9.93991	9.75175	10.24824	33
28	9.69189	9.93983	9.75205	10.24794	32
29	9.69211	9.93976	9.75234	10.24765	31
30	9.69233	9.93969	9.75264	10.24735	30
	Cofine.	Sine.	Cotang.	Tangent.	M
119					60 Degrees.

Min.	29 Degrees.				150	
	Sine.	Cofine.	Tangent.	Cotang.		
30	9.69233	9.93969	9.75264	10.24735	30	
31	9.69256	9.93962	9.75293	10.24706	29	
32	9.69278	9.93955	9.75323	10.24676	28	
33	9.69300	9.93948	9.75352	10.24647	27	
34	9.69323	9.93941	9.75382	10.24617	26	
35	9.69345	9.93933	9.75411	10.24588	25	
36	9.69367	9.93926	9.75440	10.24559	24	
37	9.69389	9.93919	9.75470	10.24529	23	
38	9.69412	9.93912	9.75499	10.24500	22	
39	9.69434	9.93905	9.75529	10.24470	21	
40	9.69456	9.93897	9.75558	10.24441	20	
41	9.69478	9.93890	9.75587	10.24412	19	
42	9.69500	9.93883	9.75617	10.24382	18	
43	9.69522	9.93876	9.75646	10.24353	17	
44	9.69545	9.93869	9.75675	10.24324	16	
45	9.69567	9.93861	9.75705	10.24294	15	
46	9.69589	9.93854	9.75734	10.24265	14	
47	9.69611	9.93847	9.75763	10.24236	13	
48	9.69633	9.93840	9.75793	10.24206	12	
49	9.69655	9.93833	9.75822	10.24177	11	
50	9.69677	9.93825	9.75851	10.24148	10	
51	9.69699	9.93818	9.75880	10.24119	9	
52	9.69721	9.93811	9.75910	10.24089	8	
53	9.69743	9.93804	9.75939	10.24060	7	
54	9.69765	9.93796	9.75968	10.24031	6	
55	9.69787	9.93789	9.75997	10.24002	5	
56	9.69809	9.93782	9.76027	10.23972	4	
57	9.69831	9.93774	9.76056	10.23943	3	
58	9.69853	9.93767	9.76085	10.23914	2	
59	9.69875	9.93760	9.76114	10.23885	1	
60	9.69897	9.93753	9.76143	10.23856	0	
	Cofine.	Sine.	Cotang.	Tangent.	Σ	
119					60 Degrees.	

Min.	30 Degrees.				149
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.69897	9.93753	9.76143	10.23856	60
1	9.69918	9.93745	9.76173	10.23826	59
2	9.69940	9.93738	9.76202	10.23797	58
3	9.69962	9.93731	9.76231	10.23768	57
4	9.69984	9.93723	9.76260	10.23739	56
5	9.70006	9.93716	9.76289	10.23710	55
6	9.70028	9.93709	9.76318	10.23681	54
7	9.70049	9.93701	9.76347	10.23652	53
8	9.70071	9.93694	9.76377	10.23622	52
9	9.70093	9.93687	9.76406	10.23593	51
10	9.70115	9.93679	9.76435	10.23564	50
11	9.70136	9.93672	9.76464	10.23535	49
12	9.70158	9.93665	9.76493	10.23506	48
13	9.70180	9.93657	9.76522	10.23477	47
14	9.70201	9.93650	9.76551	10.23448	46
15	9.70223	9.93643	9.76580	10.23419	45
16	9.70245	9.93635	9.76609	10.23390	44
17	9.70266	9.93628	9.76638	10.23361	43
18	9.70288	9.93620	9.76667	10.23332	42
19	9.70310	9.93613	9.76696	10.23303	41
20	9.70331	9.93606	9.76725	10.23274	40
21	9.70353	9.93598	9.76754	10.23245	39
22	9.70374	9.93591	9.76783	10.23216	38
23	9.70396	9.93584	9.76812	10.23187	37
24	9.70417	9.93576	9.76841	10.23158	36
25	9.70439	9.93569	9.76870	10.23129	35
26	9.70460	9.93561	9.76899	10.23100	34
27	9.70482	9.93554	9.76928	10.23071	33
28	9.70503	9.93546	9.76957	10.23042	32
29	9.70525	9.93539	9.76985	10.23014	31
30	9.70546	9.93532	9.77014	10.22985	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
120					59 Degrees.

Min.	30 Degrees.				149
	Sine.	Cofine.	Tangent.	Cotang.	
30	9.70546	9.93532	9.77014	10.22985	30
31	9.70568	9.93524	9.77043	10.22956	29
32	9.70589	9.93517	9.77072	10.22927	28
33	9.70611	9.93509	9.77101	10.22898	27
34	9.70632	9.93502	9.77130	10.22869	26
35	9.70653	9.93494	9.77159	10.22840	25
36	9.70675	9.93487	9.77188	10.22811	24
37	9.70696	9.93479	9.77216	10.22783	23
38	9.70718	9.93472	9.77245	10.22754	22
39	9.70739	9.93464	9.77274	10.22725	21
40	9.70760	9.93457	9.77303	10.22696	20
41	9.70781	9.93449	9.77332	10.22667	19
42	9.70803	9.93442	9.77360	10.22639	18
43	9.70824	9.93434	9.77389	10.22610	17
44	9.70845	9.93427	9.77418	10.22581	16
45	9.70866	9.93419	9.77447	10.22552	15
46	9.70888	9.93412	9.77475	10.22524	14
47	9.70909	9.93404	9.77504	10.22495	13
48	9.70930	9.93397	9.77533	10.22466	12
49	9.70951	9.93389	9.77562	10.22437	11
50	9.70972	9.93382	9.77590	10.22409	10
51	9.70994	9.93374	9.77619	10.22380	9
52	9.71015	9.93367	9.77648	10.22351	8
53	9.71036	9.93359	9.77676	10.22323	7
54	9.71057	9.93352	9.77705	10.22294	6
55	9.71078	9.93344	9.77734	10.22265	5
56	9.71099	9.93336	9.77762	10.22237	4
57	9.71120	9.93329	9.77791	10.22208	3
58	9.71141	9.93321	9.77820	10.22179	2
59	9.71162	9.93314	9.77848	10.22151	1
60	9.71183	9.93306	9.77877	10.22122	0
	Cofine.	Sine.	Cotang.	Tangent.	N
120					59 Degrees.

Min.	31 Degrees.				148
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.71183	9.93306	9.77877	10.22122	60
1	9.71204	9.93298	9.77905	10.22094	59
2	9.71225	9.93291	9.77934	10.22065	58
3	9.71246	9.93283	9.77963	10.22036	57
4	9.71267	9.93276	9.77991	10.22008	56
5	9.71288	9.93268	9.78020	10.21979	55
6	9.71309	9.93260	9.78048	10.21951	54
7	9.71330	9.93253	9.78077	10.21922	53
8	9.71351	9.93245	9.78106	10.21893	52
9	9.71372	9.93238	9.78134	10.21865	51
10	9.71393	9.93230	9.78163	10.21836	50
11	9.71414	9.93222	9.78191	10.21808	49
12	9.71435	9.93215	9.78220	10.21779	48
13	9.71456	9.93207	9.78248	10.21751	47
14	9.71476	9.93199	9.78277	10.21722	46
15	9.71497	9.93192	9.78305	10.21694	45
16	9.71518	9.93184	9.78334	10.21665	44
17	9.71539	9.93176	9.78362	10.21637	43
18	9.71560	9.93169	9.78391	10.21608	42
19	9.71580	9.93161	9.78419	10.21580	41
20	9.71601	9.93153	9.78447	10.21552	40
21	9.71622	9.93146	9.78476	10.21523	39
22	9.71643	9.93138	9.78504	10.21495	38
23	9.71663	9.93130	9.78533	10.21466	37
24	9.71684	9.93122	9.78561	10.21438	36
25	9.71705	9.93115	9.78590	10.21409	35
26	9.71725	9.93107	9.78618	10.21381	34
27	9.71746	9.93099	9.78646	10.21353	33
28	9.71767	9.93092	9.78675	10.21324	32
29	9.71787	9.93084	9.78703	10.21296	31
30	9.71808	9.93076	9.78731	10.21268	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
121					58 Degrees.

Min.	31 Degrees.				148
	Sine.	Cofine.	Tangent.	Cotang.	
30	9.71808	9.93076	9.78731	10.21268	30
31	9.71829	9.93068	9.78760	10.21239	29
32	9.71849	9.93061	9.78788	10.21211	28
33	9.71870	9.93053	9.78816	10.21183	27
34	9.71890	9.93045	9.78845	10.21154	26
35	9.71911	9.93037	9.78873	10.21126	25
36	9.71931	9.93030	9.78901	10.21098	24
37	9.71952	9.93022	9.78930	10.21069	23
38	9.71973	9.93014	9.78958	10.21041	22
39	9.71993	9.93006	9.78986	10.21013	21
40	9.72013	9.92998	9.79015	10.20984	20
41	9.72034	9.92991	9.79043	10.20956	19
42	9.72054	9.92983	9.79071	10.20928	18
43	9.72075	9.92975	9.79099	10.20900	17
44	9.72095	9.92967	9.79128	10.20871	16
45	9.72116	9.92959	9.79156	10.20843	15
46	9.72136	9.92952	9.79184	10.20815	14
47	9.72157	9.92944	9.79212	10.20787	13
48	9.72177	9.92936	9.79241	10.20758	12
49	9.72197	9.92928	9.79269	10.20730	11
50	9.72218	9.92920	9.79297	10.20702	10
51	9.72238	9.92912	9.79325	10.20674	9
52	9.72258	9.92905	9.79353	10.20646	8
53	9.72279	9.92897	9.79381	10.20618	7
54	9.72299	9.92889	9.79410	10.20589	6
55	9.72319	9.92881	9.79438	10.20561	5
56	9.72340	9.92873	9.79466	10.20533	4
57	9.72360	9.92865	9.79494	10.20505	3
58	9.72380	9.92857	9.79522	10.20477	2
59	9.72400	9.92849	9.79550	10.20449	1
60	9.72420	9.92842	9.79578	10.20421	0
	Cofine.	Sine.	Cotang.	Tangent.	Σ
121				58 Degrees.	

Min.	32 Degrees.				147
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.72420	9.92842	9.79578	10.20421	60
1	9.72441	9.92834	9.79607	10.20392	59
2	9.72461	9.92826	9.79635	10.20364	58
3	9.72481	9.92818	9.79663	10.20336	57
4	9.72501	9.92810	9.79691	10.20308	56
5	9.72521	9.92802	9.79719	10.20280	55
6	9.72542	9.92794	9.79747	10.20252	54
7	9.72562	9.92786	9.79775	10.20224	53
8	9.72582	9.92778	9.79803	10.20196	52
9	9.72602	9.92770	9.79831	10.20168	51
10	9.72622	9.92762	9.79859	10.20140	50
11	9.72642	9.92754	9.79887	10.20112	49
12	9.72662	9.92746	9.79915	10.20084	48
13	9.72682	9.92738	9.79943	10.20056	47
14	9.72702	9.92731	9.79971	10.20028	46
15	9.72722	9.92723	9.79999	10.20000	45
16	9.72742	9.92715	9.80027	10.19972	44
17	9.72762	9.92707	9.80055	10.19944	43
18	9.72782	9.92699	9.80083	10.19916	42
19	9.72802	9.92691	9.80111	10.19888	41
20	9.72822	9.92683	9.80139	10.19860	40
21	9.72842	9.92675	9.80167	10.19832	39
22	9.72862	9.92667	9.80195	10.19804	38
23	9.72882	9.92659	9.80223	10.19776	37
24	9.72902	9.92651	9.80251	10.19748	36
25	9.72922	9.92643	9.80279	10.19720	35
26	9.72942	9.92635	9.80307	10.19692	34
27	9.72962	9.92627	9.80335	10.19664	33
28	9.72981	9.92619	9.80362	10.19637	32
29	9.73001	9.92610	9.80390	10.19609	31
30	9.73021	9.92602	9.80418	10.19581	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
122					57 Degrees.

Min.	32 Degrees.				147	
	Sine.	Cofine.	Tangent.	Cotang.		
30	9.73021	9.92602	9.80418	10.19581	30	
31	9.73041	9.92594	9.80446	10.19553	29	
32	9.73061	9.92586	9.80474	10.19525	28	
33	9.73081	9.92578	9.80502	10.19497	27	
34	9.73100	9.92570	9.80530	10.19469	26	
35	9.73120	9.92562	9.80558	10.19441	25	
36	9.73140	9.92554	9.80585	10.19414	24	
37	9.73160	9.92546	9.80613	10.19386	23	
38	9.73179	9.92538	9.80641	10.19358	22	
39	9.73199	9.92530	9.80669	10.19330	21	
40	9.73219	9.92522	9.80697	10.19302	20	
41	9.73239	9.92514	9.80724	10.19275	19	
42	9.73258	9.92505	9.80752	10.19247	18	
43	9.73278	9.92497	9.80780	10.19219	17	
44	9.73298	9.92489	9.80808	10.19191	16	
45	9.73317	9.92481	9.80836	10.19163	15	
46	9.73337	9.92473	9.80863	10.19136	14	
47	9.73356	9.92465	9.80891	10.19108	13	
48	9.73376	9.92457	9.80919	10.19080	12	
49	9.73396	9.92449	9.80947	10.19052	11	
50	9.73415	9.92440	9.80974	10.19025	10	
51	9.73435	9.92432	9.81002	10.18997	9	
52	9.73454	9.92424	9.81030	10.18969	8	
53	9.73474	9.92416	9.81057	10.18942	7	
54	9.73493	9.92408	9.81085	10.18914	6	
55	9.73513	9.92400	9.81113	10.18886	5	
56	9.73532	9.92391	9.81141	10.18858	4	
57	9.73552	9.92383	9.81168	10.18831	3	
58	9.73571	9.92375	9.81196	10.18803	2	
59	9.73591	9.92367	9.81224	10.18775	1	
60	9.73610	9.92359	9.81251	10.18748	0	
	Cofine.	Sine.	Cotang.	Tangent.	Σ	
122		57 Degrees.				

Min.	33 Degrees.				146
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.73610	9.92359	9.81251	10.18748	60
1	9.73630	9.92350	9.81279	10.18720	59
2	9.73649	9.92342	9.81307	10.18692	58
3	9.73669	9.92334	9.81334	10.18665	57
4	9.73688	9.92326	9.81362	10.18637	56
5	9.73707	9.92318	9.81389	10.18610	55
6	9.73727	9.92309	9.81417	10.18582	54
7	9.73746	9.92301	9.81445	10.18554	53
8	9.73766	9.92293	9.81472	10.18527	52
9	9.73785	9.92285	9.81500	10.18499	51
10	9.73804	9.92276	9.81527	10.18472	50
11	9.73824	9.92268	9.81555	10.18444	49
12	9.73843	9.92260	9.81583	10.18416	48
13	9.73862	9.92252	9.81610	10.18389	47
14	9.73882	9.92243	9.81638	10.18361	46
15	9.73901	9.92235	9.81665	10.18334	45
16	9.73920	9.92227	9.81693	10.18306	44
17	9.73939	9.92218	9.81720	10.18279	43
18	9.73959	9.92210	9.81748	10.18251	42
19	9.73978	9.92202	9.81775	10.18224	41
20	9.73997	9.92194	9.81803	10.18196	40
21	9.74016	9.92185	9.81830	10.18169	39
22	9.74035	9.92177	9.81858	10.18141	38
23	9.74055	9.92169	9.81885	10.18114	37
24	9.74074	9.92160	9.81913	10.18086	36
25	9.74093	9.92152	9.81940	10.18059	35
26	9.74112	9.92144	9.81968	10.18031	34
27	9.74131	9.92135	9.81995	10.18004	33
28	9.74150	9.92127	9.82023	10.17976	32
29	9.74169	9.92119	9.82050	10.17949	31
30	9.74188	9.92110	9.82078	10.17921	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
123					56 Degrees.

Min.	33 Degrees.				146	
	Sine.	Cofine.	Tangent.	Cotang.		
30	9.74188	9.92110	9.82078	10.17921	30	
31	9.74208	9.92102	9.82105	10.17894	29	
32	9.74227	9.92093	9.82133	10.17866	28	
33	9.74246	9.92085	9.82160	10.17839	27	
34	9.74265	9.92077	9.82188	10.17811	26	
35	9.74284	9.92068	9.82215	10.17784	25	
36	9.74303	9.92060	9.82242	10.17757	24	
37	9.74322	9.92052	9.82270	10.17729	23	
38	9.74341	9.92043	9.82297	10.17702	22	
39	9.74360	9.92035	9.82325	10.17674	21	
40	9.74379	9.92026	9.82352	10.17647	20	
41	9.74398	9.92018	9.82379	10.17620	19	
42	9.74417	9.92009	9.82407	10.17592	18	
43	9.74436	9.92001	9.82434	10.17565	17	
44	9.74454	9.91993	9.82461	10.17538	16	
45	9.74473	9.91984	9.82489	10.17510	15	
46	9.74492	9.91976	9.82516	10.17483	14	
47	9.74511	9.91967	9.82543	10.17456	13	
48	9.74530	9.91959	9.82571	10.17428	12	
49	9.74549	9.91950	9.82598	10.17401	11	
50	9.74568	9.91942	9.82625	10.17374	10	
51	9.74587	9.91933	9.82653	10.17346	9	
52	9.74605	9.91925	9.82680	10.17319	8	
53	9.74624	9.91916	9.82707	10.17292	7	
54	9.74643	9.91908	9.82735	10.17264	6	
55	9.74662	9.91899	9.82762	10.17237	5	
56	9.74681	9.91891	9.82789	10.17210	4	
57	9.74699	9.91882	9.82816	10.17183	3	
58	9.74718	9.91874	9.82844	10.17155	2	
59	9.74737	9.91865	9.82871	10.17128	1	
60	9.74756	9.91857	9.82898	10.17101	0	
	Cofine.	Sine.	Cotang.	Tangent.	Σ	
123					56 Degrees.	

Min.	34 Degrees.				145
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.74756	9.91857	9.82898	10.17101	60
1	9.74774	9.91848	9.82925	10.17074	59
2	9.74793	9.91840	9.82953	10.17046	58
3	9.74812	9.91831	9.82980	10.17019	57
4	9.74830	9.91823	9.83007	10.16992	56
5	9.74849	9.91814	9.83034	10.16965	55
6	9.74808	9.91806	9.83062	10.16937	54
7	9.74886	9.91797	9.83089	10.16910	53
8	9.74905	9.91789	9.83116	10.16883	52
9	9.74924	9.91780	9.83143	10.16856	51
10	9.74942	9.91771	9.83170	10.16829	50
11	9.74961	9.91763	9.83198	10.16801	49
12	9.74980	9.91754	9.83225	10.16774	48
13	9.74998	9.91746	9.83252	10.16747	47
14	9.75017	9.91737	9.83279	10.16720	46
15	9.75035	9.91729	9.83306	10.16693	45
16	9.75054	9.91720	9.83333	10.16666	44
17	9.75072	9.91711	9.83361	10.16638	43
18	9.75091	9.91703	9.83388	10.16611	42
19	9.75109	9.91694	9.83415	10.16584	41
20	9.75128	9.91685	9.83442	10.16557	40
21	9.75146	9.91677	9.83469	10.16530	39
22	9.75165	9.91668	9.83496	10.16503	38
23	9.75183	9.91660	9.83523	10.16476	37
24	9.75202	9.91651	9.83550	10.16449	36
25	9.75220	9.91642	9.83578	10.16421	35
26	9.75239	9.91634	9.83605	10.16394	34
27	9.75257	9.91625	9.83632	10.16367	33
28	9.75276	9.91616	9.83659	10.16340	32
29	9.75294	9.91608	9.83686	10.16313	31
30	9.75312	9.91599	9.83713	10.16286	30
	Cofine.	Sine.	Cotang.	Tangent.	N
124					55 Degrees.

34 Degrees.					145	
Min.	Sine.	Cofine.	Tangent.	Cotang.		
30	9.75312	9.91599	9.83713	10.16286	30	
31	9.75331	9.91590	9.83740	10.16259	29	
32	9.75349	9.91582	9.83767	10.16232	28	
33	9.75367	9.91573	9.83794	10.16205	27	
34	9.75386	9.91564	9.83821	10.16178	26	
35	9.75404	9.91555	9.83848	10.16151	25	
36	9.75422	9.91547	9.83875	10.16124	24	
37	9.75441	9.91538	9.83902	10.16097	23	
38	9.75459	9.91529	9.83929	10.16070	22	
39	9.75477	9.91521	9.83956	10.16043	21	
40	9.75496	9.91512	9.83983	10.16016	20	
41	9.75514	9.91503	9.84010	10.15989	19	
42	9.75532	9.91494	9.84037	10.15962	18	
43	9.75550	9.91486	9.84064	10.15935	17	
44	9.75569	9.91477	9.84091	10.15908	16	
45	9.75587	9.91468	9.84118	10.15881	15	
46	9.75605	9.91459	9.84145	10.15854	14	
47	9.75623	9.91450	9.84172	10.15827	13	
48	9.75641	9.91442	9.84199	10.15800	12	
49	9.75659	9.91433	9.84226	10.15773	11	
50	9.75678	9.91424	9.84253	10.15746	10	
51	9.75696	9.91415	9.84280	10.15719	9	
52	9.75714	9.91407	9.84307	10.15692	8	
53	9.75732	9.91398	9.84334	10.15665	7	
54	9.75750	9.91389	9.84361	10.15638	6	
55	9.75768	9.91380	9.84388	10.15611	5	
56	9.75786	9.91371	9.84415	10.15584	4	
57	9.75804	9.91362	9.84441	10.15558	3	
58	9.75823	9.91354	9.84468	10.15531	2	
59	9.75841	9.91345	9.84495	10.15504	1	
60	9.75859	9.91336	9.84522	10.15477	0	
	Cofine.	Sine.	Cotang.	Tangent.	Σ	
124					55 Degrees.	

Min.	35 Degrees.				144
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.75859	9.91336	9.84522	10.15477	60
1	9.75877	9.91327	9.84549	10.15450	59
2	9.75895	9.91318	9.84576	10.15423	58
3	9.75913	9.91309	9.84603	10.15396	57
4	9.75931	9.91301	9.84630	10.15369	56
5	9.75949	9.91292	9.84657	10.15342	55
6	9.75967	9.91283	9.84683	10.15316	54
7	9.75985	9.91274	9.84710	10.15289	53
8	9.76003	9.91265	9.84737	10.15262	52
9	9.76021	9.91256	9.84764	10.15235	51
10	9.76038	9.91247	9.84791	10.15208	50
11	9.76056	9.91238	9.84818	10.15181	49
12	9.76074	9.91229	9.84844	10.15155	48
13	9.76092	9.91220	9.84871	10.15128	47
14	9.76110	9.91212	9.84898	10.15101	46
15	9.76128	9.91203	9.84925	10.15074	45
16	9.76146	9.91194	9.84952	10.15047	44
17	9.76164	9.91185	9.84978	10.15021	43
18	9.76182	9.91176	9.85005	10.14994	42
19	9.76199	9.91167	9.85032	10.14967	41
20	9.76217	9.91158	9.85059	10.14940	40
21	9.76235	9.91149	9.85086	10.14913	39
22	9.76253	9.91140	9.85112	10.14887	38
23	9.76271	9.91131	9.85139	10.14860	37
24	9.76288	9.91122	9.85166	10.14833	36
25	9.76306	9.91113	9.85193	10.14806	35
26	9.76324	9.91104	9.85219	10.14780	34
27	9.76342	9.91095	9.85246	10.14753	33
28	9.76359	9.91086	9.85273	10.14726	32
29	9.76377	9.91077	9.85300	10.14699	31
30	9.76395	9.91068	9.85326	10.14673	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
125					54 Degrees.

Min.	35 Degrees.				144	
	Sine.	Cofine.	Tangent.	Cotang.		
30	9.76395	9.91068	9.85326	10.14673	30	
31	9.76413	9.91059	9.85353	10.14646	29	
32	9.76430	9.91050	9.85380	10.14619	28	
33	9.76448	9.91041	9.85406	10.14593	27	
34	9.76466	9.91032	9.85433	10.14566	26	
35	9.76483	9.91023	9.85460	10.14539	25	
36	9.76501	9.91014	9.85487	10.14512	24	
37	9.76519	9.91005	9.85513	10.14486	23	
38	9.76536	9.90996	9.85540	10.14459	22	
39	9.76554	9.90987	9.85567	10.14432	21	
40	9.76571	9.90978	9.85593	10.14406	20	
41	9.76589	9.90969	9.85620	10.14379	19	
42	9.76607	9.90960	9.85647	10.14352	18	
43	9.76624	9.90950	9.85673	10.14326	17	
44	9.76642	9.90941	9.85700	10.14299	16	
45	9.76659	9.90932	9.85727	10.14272	15	
46	9.76677	9.90923	9.85753	10.14246	14	
47	9.76694	9.90914	9.85780	10.14219	13	
48	9.76712	9.90905	9.85806	10.14193	12	
49	9.76729	9.90896	9.85833	10.14166	11	
50	9.76747	9.90887	9.85860	10.14139	10	
51	9.76764	9.90878	9.85886	10.14113	9	
52	9.76782	9.90869	9.85913	10.14086	8	
53	9.76799	9.90859	9.85940	10.14059	7	
54	9.76817	9.90850	9.85966	10.14033	6	
55	9.76834	9.90841	9.85993	10.14006	5	
56	9.76852	9.90832	9.86019	10.13980	4	
57	9.76869	9.90823	9.86046	10.13953	3	
58	9.76887	9.90814	9.86072	10.13927	2	
59	9.76904	9.90804	9.86099	10.13900	1	
60	9.76921	9.90795	9.86126	10.13873	0	
	Cofine.	Sine.	Cotang.	Tangent.	Σ	
125					54 Degrees.	

Min.	36 Degrees.				143
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.76921	9.90795	9.86126	10.13873	60
1	9.76939	9.90786	9.86152	10.13847	59
2	9.76956	9.90777	9.86179	10.13820	58
3	9.76973	9.90768	9.86205	10.13794	57
4	9.76991	9.90759	9.86232	10.13767	56
5	9.77008	9.90749	9.86258	10.13741	55
6	9.77026	9.90740	9.86285	10.13714	54
7	9.77043	9.90731	9.86311	10.13688	53
8	9.77060	9.90722	9.86338	10.13661	52
9	9.77077	9.90712	9.86365	10.13635	51
10	9.77095	9.90703	9.86391	10.13608	50
11	9.77112	9.90694	9.86418	10.13581	49
12	9.77129	9.90685	9.86444	10.13555	48
13	9.77147	9.90675	9.86471	10.13528	47
14	9.77164	9.90666	9.86497	10.13502	46
15	9.77181	9.90657	9.86524	10.13475	45
16	9.77198	9.90648	9.86550	10.13449	44
17	9.77215	9.90638	9.86577	10.13422	43
18	9.77233	9.90629	9.86603	10.13396	42
19	9.77250	9.90620	9.86629	10.13370	41
20	9.77267	9.90611	9.86656	10.13343	40
21	9.77284	9.90601	9.86682	10.13317	39
22	9.77301	9.90592	9.86709	10.13290	38
23	9.77319	9.90583	9.86735	10.13264	37
24	9.77336	9.90573	9.86762	10.13237	36
25	9.77353	9.90564	9.86788	10.13211	35
26	9.77370	9.90555	9.86815	10.13184	34
27	9.77387	9.90545	9.86841	10.13158	33
28	9.77404	9.90536	9.86868	10.13131	32
29	9.77421	9.90527	9.86894	10.13105	31
30	9.77438	9.90517	9.86920	10.13079	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
	126				53 Degrees.

Min.	36 Degrees.				143	
	Sine.	Cofine.	Tangent.	Cotang.		
30	9.77438	9.90517	9.86920	10.13079	30	
31	9.77455	9.90508	9.86947	10.13052	29	
32	9.77472	9.90499	9.86973	10.13026	28	
33	9.77489	9.90489	9.87000	10.12999	27	
34	9.77506	9.90480	9.87026	10.12973	26	
35	9.77523	9.90471	9.87052	10.12947	25	
36	9.77541	9.90461	9.87079	10.12920	24	
37	9.77558	9.90452	9.87105	10.12894	23	
38	9.77575	9.90442	9.87132	10.12867	22	
39	9.77591	9.90433	9.87158	10.12841	21	
40	9.77608	9.90424	9.87184	10.12815	20	
41	9.77625	9.90414	9.87211	10.12788	19	
42	9.77642	9.90405	9.87237	10.12762	18	
43	9.77659	9.90395	9.87263	10.12736	17	
44	9.77676	9.90386	9.87290	10.12709	16	
45	9.77693	9.90377	9.87316	10.12683	15	
46	9.77710	9.90367	9.87343	10.12656	14	
47	9.77727	9.90358	9.87369	10.12630	13	
48	9.77744	9.90348	9.87395	10.12604	12	
49	9.77761	9.90339	9.87422	10.12577	11	
50	9.77778	9.90329	9.87448	10.12551	10	
51	9.77795	9.90320	9.87474	10.12525	9	
52	9.77811	9.90310	9.87501	10.12498	8	
53	9.77828	9.90301	9.87527	10.12472	7	
54	9.77845	9.90291	9.87553	10.12446	6	
55	9.77862	9.90282	9.87579	10.12420	5	
56	9.77879	9.90272	9.87606	10.12393	4	
57	9.77895	9.90263	9.87632	10.12367	3	
58	9.77912	9.90253	9.87658	10.12341	2	
59	9.77929	9.90244	9.87685	10.12314	1	
60	9.77946	9.90234	9.87711	10.12288	0	
	Cofine.	Sine.	Cotang.	Tangent.		N
126				53 Degrees.		

37 Degrees.					142
Min.	Sine.	Cofine.	Tangent.	Cotang.	
0	9.77946	9.90234	9.87711	10.12288	60
1	9.77963	9.90225	9.87737	10.12262	59
2	9.77979	9.90215	9.87764	10.12236	58
3	9.77996	9.90206	9.87790	10.12209	57
4	9.78013	9.90196	9.87816	10.12183	56
5	9.78030	9.90187	9.87842	10.12157	55
6	9.78046	9.90177	9.87869	10.12130	54
7	9.78063	9.90168	9.87895	10.12104	53
8	9.78080	9.90158	9.87921	10.12078	52
9	9.78096	9.90148	9.87947	10.12052	51
10	9.78113	9.90139	9.87974	10.12025	50
11	9.78130	9.90129	9.88000	10.11999	49
12	9.78146	9.90120	9.88026	10.11973	48
13	9.78163	9.90110	9.88052	10.11947	47
14	9.78180	9.90101	9.88079	10.11921	46
15	9.78196	9.90091	9.88105	10.11894	45
16	9.78213	9.90081	9.88131	10.11868	44
17	9.78229	9.90072	9.88157	10.11842	43
18	9.78246	9.90062	9.88183	10.11816	42
19	9.78263	9.90052	9.88210	10.11789	41
20	9.78279	9.90043	9.88236	10.11763	40
21	9.78296	9.90033	9.88262	10.11737	39
22	9.78312	9.90024	9.88288	10.11711	38
23	9.78329	9.90014	9.88314	10.11685	37
24	9.78345	9.90004	9.88341	10.11658	36
25	9.78362	9.89995	9.88367	10.11632	35
26	9.78378	9.89985	9.88393	10.11606	34
27	9.78395	9.89975	9.88419	10.11580	33
28	9.78411	9.89966	9.88445	10.11554	32
29	9.78428	9.89956	9.88471	10.11528	31
30	9.78444	9.89946	9.88498	10.11501	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
127	52 Degrees.				

Min.	37 Degrees.				142	
	Sine.	Cofine.	Tangent.	Cotang.		
30	9.78444	9.89946	9.88498	10.11501	30	
31	9.78461	9.89936	9.88524	10.11475	29	
32	9.78477	9.89927	9.88550	10.11449	28	
33	9.78494	9.89917	9.88576	10.11423	27	
34	9.78510	9.89907	9.88602	10.11397	26	
35	9.78526	9.89898	9.88628	10.11371	25	
36	9.78543	9.89888	9.88654	10.11345	24	
37	9.78559	9.89878	9.88681	10.11318	23	
38	9.78576	9.89868	9.88707	10.11292	22	
39	9.78592	9.89859	9.88733	10.11266	21	
40	9.78608	9.89849	9.88759	10.11240	20	
41	9.78625	9.89839	9.88785	10.11214	19	
42	9.78641	9.89829	9.88811	10.11188	18	
43	9.78657	9.89820	9.88837	10.11162	17	
44	9.78674	9.89810	9.88863	10.11136	16	
45	9.78690	9.89800	9.88889	10.11110	15	
46	9.78706	9.89790	9.88916	10.11083	14	
47	9.78723	9.89781	9.88942	10.11057	13	
48	9.78739	9.89771	9.88968	10.11031	12	
49	9.78755	9.89761	9.88994	10.11005	11	
50	9.78772	9.89751	9.89020	10.10979	10	
51	9.78788	9.89741	9.89046	10.10953	9	
52	9.78804	9.89731	9.89072	10.10927	8	
53	9.78820	9.89722	9.89098	10.10901	7	
54	9.78837	9.89712	9.89124	10.10875	6	
55	9.78853	9.89702	9.89150	10.10849	5	
56	9.78869	9.89692	9.89176	10.10823	4	
57	9.78885	9.89682	9.89202	10.10797	3	
58	9.78901	9.89672	9.89228	10.10771	2	
59	9.78918	9.89663	9.89254	10.10745	1	
60	9.78934	9.89653	9.89280	10.10719	0	
	Cofine.	Sine.	Cotang.	Tangent.	Σ	
127					52 Degrees.	

Min.	38 Degrees.				141
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.78934	9.89653	9.89280	10.10719	60
1	9.78950	9.89643	9.89307	10.10692	59
2	9.78966	9.89633	9.89333	10.10666	58
3	9.78982	9.89623	9.89359	10.10640	57
4	9.78998	9.89613	9.89385	10.10614	56
5	9.79014	9.89603	9.89411	10.10588	55
6	9.79031	9.89593	9.89437	10.10562	54
7	9.79047	9.89583	9.89463	10.10536	53
8	9.79063	9.89574	9.89489	10.10510	52
9	9.79079	9.89564	9.89515	10.10484	51
10	9.79095	9.89554	9.89541	10.10458	50
11	9.79111	9.89544	9.89567	10.10432	49
12	9.79127	9.89534	9.89593	10.10406	48
13	9.79143	9.89524	9.89619	10.10380	47
14	9.79159	9.89514	9.89645	10.10354	46
15	9.79175	9.89504	9.89671	10.10328	45
16	9.79191	9.89494	9.89697	10.10302	44
17	9.79207	9.89484	9.89723	10.10276	43
18	9.79223	9.89474	9.89749	10.10250	42
19	9.79239	9.89464	9.89775	10.10224	41
20	9.79255	9.89454	9.89801	10.10198	40
21	9.79271	9.89444	9.89827	10.10173	39
22	9.79287	9.89434	9.89852	10.10147	38
23	9.79303	9.89424	9.89878	10.10121	37
24	9.79319	9.89414	9.89904	10.10095	36
25	9.79335	9.89404	9.89930	10.10069	35
26	9.79351	9.89394	9.89956	10.10043	34
27	9.79367	9.89384	9.89982	10.10017	33
28	9.79383	9.89374	9.90008	10.09991	32
29	9.79399	9.89364	9.90034	10.09965	31
30	9.79414	9.89354	9.90060	10.09939	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
128					51 Degrees.

Min.	38 Degrees.				141
	Sine.	Cofine.	Tangent.	Cotang.	
30	9.79414	9.89354	9.90060	10.09939	30
31	9.79430	9.89344	9.90086	10.09913	29
32	9.79446	9.89334	9.90112	10.09887	28
33	9.79462	9.89324	9.90138	10.09861	27
34	9.79478	9.89314	9.90164	10.09835	26
35	9.79494	9.89304	9.90190	10.09809	25
36	9.79510	9.89294	9.90216	10.09783	24
37	9.79525	9.89283	9.90241	10.09758	23
38	9.79541	9.89273	9.90267	10.09732	22
39	9.79557	9.89263	9.90293	10.09706	21
40	9.79573	9.89253	9.90319	10.09680	20
41	9.79589	9.89243	9.90345	10.09654	19
42	9.79604	9.89233	9.90371	10.09628	18
43	9.79620	9.89223	9.90397	10.09602	17
44	9.79636	9.89213	9.90423	10.09576	16
45	9.79652	9.89203	9.90449	10.09550	15
46	9.79667	9.89192	9.90474	10.09525	14
47	9.79683	9.89182	9.90500	10.09499	13
48	9.79699	9.89172	9.90526	10.09473	12
49	9.79715	9.89162	9.90552	10.09447	11
50	9.79730	9.89152	9.90578	10.09421	10
51	9.79746	9.89142	9.90604	10.09395	9
52	9.79762	9.89131	9.90630	10.09369	8
53	9.79777	9.89121	9.90656	10.09343	7
54	9.79793	9.89111	9.90681	10.09318	6
55	9.79809	9.89101	9.90707	10.09292	5
56	9.79824	9.89091	9.90733	10.09266	4
57	9.79840	9.89080	9.90759	10.09240	3
58	9.79855	9.89070	9.90785	10.09214	2
59	9.79871	9.89060	9.90811	10.09188	1
60	9.79887	9.89050	9.90836	10.09163	0
	Cofine.	Sine.	Cotang.	Tangent.	Σ
128					51 Degrees.

Min.	39 Degrees.				140
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.79887	9.89050	9.90836	10.09163	60
1	9.79902	9.89040	9.90862	10.09137	59
2	9.79918	9.89029	9.90888	10.09111	58
3	9.79933	9.89019	9.90914	10.09085	57
4	9.79949	9.89009	9.90940	10.09059	56
5	9.79965	9.88999	9.90966	10.09033	55
6	9.79980	9.88988	9.90991	10.09008	54
7	9.79996	9.88978	9.91017	10.08982	53
8	9.80011	9.88968	9.91043	10.08956	52
9	9.80027	9.88957	9.91069	10.08930	51
10	9.80042	9.88947	9.91095	10.08904	50
11	9.80058	9.88937	9.91120	10.08879	49
12	9.80073	9.88927	9.91146	10.08853	48
13	9.80089	9.88916	9.91172	10.08827	47
14	9.80104	9.88906	9.91198	10.08801	46
15	9.80120	9.88896	9.91224	10.08775	45
16	9.80135	9.88885	9.91249	10.08750	44
17	9.80151	9.88875	9.91275	10.08724	43
18	9.80166	9.88865	9.91301	10.08698	42
19	9.80181	9.88854	9.91327	10.08672	41
20	9.80197	9.88844	9.91352	10.08647	40
21	9.80212	9.88834	9.91378	10.08621	39
22	9.80228	9.88823	9.91404	10.08595	38
23	9.80243	9.88813	9.91430	10.08569	37
24	9.80258	9.88802	9.91455	10.08544	36
25	9.80274	9.88792	9.91481	10.08518	35
26	9.80289	9.88782	9.91507	10.08492	34
27	9.80305	9.88771	9.91533	10.08466	33
28	9.80320	9.88761	9.91558	10.08441	32
29	9.80335	9.88751	9.91584	10.08415	31
30	9.80351	9.88740	9.91610	10.08389	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
129					50 Degrees.

Min.	39 Degrees.				140
	Sine.	Cofine.	Tangent	Cotang.	
30	9.80351	9.88740	9.91610	10.08389	30
31	9.80366	9.88730	9.91636	10.08363	29
32	9.80381	9.88719	9.91661	10.08338	28
33	9.80396	9.88709	9.91687	10.08312	27
34	9.80412	9.88698	9.91713	10.08286	26
35	9.80427	9.88688	9.91739	10.08260	25
36	9.80442	9.88678	9.91764	10.08235	24
37	9.80458	9.88667	9.91790	10.08209	23
38	9.80473	9.88657	9.91816	10.08183	22
39	9.80488	9.88646	9.91841	10.08158	21
40	9.80503	9.88636	9.91867	10.08132	20
41	9.80519	9.88625	9.91893	10.08106	19
42	9.80534	9.88615	9.91919	10.08080	18
43	9.80549	9.88604	9.91944	10.08055	17
44	9.80564	9.88594	9.91970	10.08029	16
45	9.80579	9.88583	9.91996	10.08003	15
46	9.80595	9.88573	9.92021	10.07978	14
47	9.80610	9.88562	9.92047	10.07952	13
48	9.80625	9.88552	9.92073	10.07926	12
49	9.80640	9.88541	9.92098	10.07901	11
50	9.80655	9.88531	9.92124	10.07875	10
51	9.80670	9.88520	9.92150	10.07849	9
52	9.80686	9.88510	9.92176	10.07823	8
53	9.80701	9.88499	9.92201	10.07798	7
54	9.80716	9.88488	9.92227	10.07772	6
55	9.80731	9.88478	9.92253	10.07746	5
56	9.80746	9.88467	9.92278	10.07721	4
57	9.80761	9.88457	9.92304	10.07695	3
58	9.80776	9.88446	9.92330	10.07669	2
59	9.80791	9.88435	9.92355	10.07644	1
60	9.80806	9.88425	9.92381	10.07618	0
	Cofine.	Sine.	Cotang.	Tangent.	Σ
129					50 Degrees.

Min.	40 Degrees.				139
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.80806	9.88425	9.92381	10.07618	60
1	9.80821	9.88414	9.92407	10.07592	59
2	9.80836	9.88404	9.92432	10.07567	58
3	9.80851	9.88393	9.92458	10.07541	57
4	9.80866	9.88382	9.92483	10.07516	56
5	9.80881	9.88372	9.92509	10.07490	55
6	9.80896	9.88361	9.92535	10.07464	54
7	9.80911	9.88351	9.92560	10.07439	53
8	9.80926	9.88340	9.92586	10.07413	52
9	9.80941	9.88329	9.92612	10.07387	51
10	9.80956	9.88319	9.92637	10.07362	50
11	9.80971	9.88308	9.92663	10.07336	49
12	9.80986	9.88297	9.92689	10.07310	48
13	9.81001	9.88287	9.92714	10.07285	47
14	9.81016	9.88276	9.92740	10.07259	46
15	9.81031	9.88265	9.92765	10.07234	45
16	9.81046	9.88254	9.92791	10.07208	44
17	9.81061	9.88244	9.92817	10.07182	43
18	9.81076	9.88233	9.92842	10.07157	42
19	9.81091	9.88222	9.92868	10.07131	41
20	9.81106	9.88212	9.92893	10.07106	40
21	9.81120	9.88201	9.92919	10.07080	39
22	9.81135	9.88190	9.92945	10.07054	38
23	9.81150	9.88179	9.92970	10.07029	37
24	9.81165	9.88169	9.92996	10.07003	36
25	9.81180	9.88158	9.93021	10.06978	35
26	9.81195	9.88147	9.93047	10.06952	34
27	9.81210	9.88136	9.93073	10.06926	33
28	9.81224	9.88126	9.93098	10.06901	32
29	9.81239	9.88115	9.93124	10.06875	31
30	9.81254	9.88104	9.93149	10.06850	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
130					49 Degrees.

Min.	40 Degrees.				139
	Sine.	Cofine.	Tangent.	Cotang.	
30	9.81254	9.88104	9.93149	10.06850	30
31	9.81269	9.88093	9.93175	10.06824	29
32	9.81284	9.88082	9.93201	10.06798	28
33	9.81298	9.88072	9.93226	10.06773	27
34	9.81315	9.88061	9.93252	10.06747	26
35	9.81328	9.88050	9.93277	10.06722	25
36	9.81343	9.88039	9.93303	10.06696	24
37	9.81357	9.88028	9.93328	10.06671	23
38	9.81372	9.88018	9.93354	10.06645	22
39	9.81387	9.88007	9.93380	10.06619	21
40	9.81401	9.87996	9.93405	10.06594	20
41	9.81416	9.87985	9.93431	10.06568	19
42	9.81431	9.87974	9.93456	10.06543	18
43	9.81446	9.87963	9.93482	10.06517	17
44	9.81460	9.87952	9.93507	10.06492	16
45	9.81475	9.87941	9.93533	10.06466	15
46	9.81489	9.87931	9.93558	10.06441	14
47	9.81504	9.87920	9.93584	10.06415	13
48	9.81519	9.87909	9.93609	10.06390	12
49	9.81533	9.87898	9.93635	10.06364	11
50	9.81548	9.87887	9.93661	10.06338	10
51	9.81563	9.87876	9.93686	10.06313	9
52	9.81577	9.87865	9.93712	10.06287	8
53	9.81592	9.87854	9.93737	10.06262	7
54	9.81606	9.87843	9.93763	10.06236	6
55	9.81621	9.87832	9.93788	10.06211	5
56	9.81636	9.87821	9.93814	10.06185	4
57	9.81650	9.87810	9.93839	10.06160	3
58	9.81665	9.87799	9.93865	10.06134	2
59	9.81679	9.87788	9.93890	10.06109	1
60	9.81694	9.87777	9.93916	10.06083	0
	Cofine.	Sine.	Cotang.	Tangent.	Σ
130					49 Degrees.

Min.	41 Degrees.				138
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.81694	9.87777	9.93916	10.06083	60
1	9.81708	9.87767	9.93941	10.06058	59
2	9.81723	9.87756	9.93967	10.06032	58
3	9.81737	9.87745	9.93992	10.06007	57
4	9.81752	9.87734	9.94018	10.05981	56
5	9.81766	9.87723	9.94043	10.05956	55
6	9.81781	9.87711	9.94069	10.05930	54
7	9.81795	9.87700	9.94094	10.05905	53
8	9.81810	9.87689	9.94120	10.05879	52
9	9.81824	9.87678	9.94145	10.05854	51
10	9.81839	9.87667	9.94171	10.05828	50
11	9.81853	9.87656	9.94196	10.05803	49
12	9.81868	9.87645	9.94222	10.05777	48
13	9.81882	9.87634	9.94247	10.05752	47
14	9.81896	9.87623	9.94273	10.05726	46
15	9.81911	9.87612	9.94298	10.05701	45
16	9.81925	9.87601	9.94324	10.05675	44
17	9.81940	9.87590	9.94349	10.05650	43
18	9.81954	9.87579	9.94375	10.05624	42
19	9.81968	9.87568	9.94400	10.05599	41
20	9.81983	9.87557	9.94426	10.05573	40
21	9.81997	9.87545	9.94451	10.05548	39
22	9.82011	9.87534	9.94477	10.05522	38
23	9.82026	9.87523	9.94502	10.05497	37
24	9.82040	9.87512	9.94528	10.05471	36
25	9.82054	9.87501	9.94553	10.05446	35
26	9.82069	9.87490	9.94579	10.05421	34
27	9.82083	9.87479	9.94604	10.05395	33
28	9.82097	9.87467	9.94629	10.05370	32
29	9.82112	9.87456	9.94655	10.05344	31
30	9.82126	9.87445	9.94680	10.05319	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
131					48 Degrees.

Min.	41 Degrees.				138
	Sine.	Cofine.	Tangent.	Cotang.	
30	9.82126	9.87445	9.94680	10.05319	30
31	9.82140	9.87434	9.94706	10.05293	29
32	9.82155	9.87423	9.94731	10.05268	28
33	9.82169	9.87412	9.94757	10.05242	27
34	9.82183	9.87400	9.94782	10.05217	26
35	9.82197	9.87389	9.94808	10.05191	25
36	9.82211	9.87378	9.94833	10.05166	24
37	9.82226	9.87367	9.94858	10.05141	23
38	9.82240	9.87355	9.94884	10.05115	22
39	9.82254	9.87344	9.94909	10.05090	21
40	9.82268	9.87333	9.94935	10.05064	20
41	9.82283	9.87322	9.94960	10.05039	19
42	9.82297	9.87311	9.94986	10.05013	18
43	9.82311	9.87299	9.95011	10.04988	17
44	9.82325	9.87288	9.95037	10.04962	16
45	9.82330	9.87277	9.95062	10.04937	15
46	9.82353	9.87265	9.95087	10.04912	14
47	9.82368	9.87254	9.95113	10.04886	13
48	9.82382	9.87243	9.95138	10.04861	12
49	9.82396	9.87232	9.95164	10.04835	11
50	9.82410	9.87220	9.95189	10.04810	10
51	9.82424	9.87209	9.95215	10.04784	9
52	9.82438	9.87198	9.95240	10.04759	8
53	9.82452	9.87186	9.95265	10.04734	7
54	9.82466	9.87175	9.95291	10.04708	6
55	9.82480	9.87164	9.95316	10.04683	5
56	9.82494	9.87152	9.95342	10.04657	4
57	9.82508	9.87141	9.95367	10.04632	3
58	9.82523	9.87130	9.95392	10.04607	2
59	9.82537	9.87118	9.95418	10.04581	1
60	9.82551	9.87107	9.95443	10.04556	0
	Cofine.	Sine.	Cotang.	Tangent.	M

131

48 Degrees.

Min.	42 Degrees.				137
	Sine.	Cofine.	Tangent.	Cotang.	
30	9.82968	9.86763	9.96205	10.03794	30
31	9.82982	9.86751	9.96230	10.03769	29
32	9.82995	9.86739	9.96255	10.03744	28
33	9.83009	9.86728	9.96281	10.03718	27
34	9.83023	9.86716	9.96306	10.03693	26
35	9.83037	9.86705	9.96332	10.03667	25
36	9.83050	9.86693	9.96357	10.03642	24
37	9.83064	9.86681	9.96382	10.03617	23
38	9.83078	9.86670	9.96408	10.03591	22
39	9.83092	9.86658	9.96433	10.03566	21
40	9.83105	9.86646	9.96458	10.03541	20
41	9.83119	9.86635	9.96484	10.03515	19
42	9.83133	9.86623	9.96509	10.03490	18
43	9.83146	9.86612	9.96534	10.03465	17
44	9.83160	9.86600	9.96560	10.03439	16
45	9.83174	9.86588	9.96585	10.03414	15
46	9.83187	9.86577	9.96610	10.03389	14
47	9.83201	9.86565	9.96636	10.03363	13
48	9.83215	9.86553	9.96661	10.03338	12
49	9.83228	9.86541	9.96686	10.03313	11
50	9.83242	9.86530	9.96712	10.03287	10
51	9.83256	9.86518	9.96737	10.03262	9
52	9.83269	9.86506	9.96762	10.03237	8
53	9.83283	9.86495	9.96788	10.03211	7
54	9.83296	9.86483	9.96813	10.03186	6
55	9.83310	9.86471	9.96838	10.03161	5
56	9.83324	9.86459	9.96864	10.03135	4
57	9.83337	9.86448	9.96889	10.03110	3
58	9.83351	9.86436	9.96914	10.03085	2
59	9.83364	9.86424	9.96940	10.03059	1
60	9.83378	9.86412	9.96965	10.03034	0
	Cofine.	Sine.	Cotang.	Tangent.	Σ

132

47 Degrees.

Min.	42 Degrees.				137
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.82551	9.87107	9.95443	10.04556	60
1	9.82565	9.87095	9.95469	10.04530	59
2	9.82579	9.87084	9.95494	10.04505	58
3	9.82593	9.87073	9.95519	10.04480	57
4	9.82607	9.87061	9.95545	10.04454	56
5	9.82621	9.87050	9.95570	10.04429	55
6	9.82635	9.87038	9.95596	10.04403	54
7	9.82649	9.87027	9.95621	10.04378	53
8	9.82663	9.87016	9.95646	10.04353	52
9	9.82677	9.87004	9.95672	10.04327	51
10	9.82690	9.86993	9.95697	10.04302	50
11	9.82704	9.86981	9.95723	10.04276	49
12	9.82718	9.86970	9.95748	10.04251	48
13	9.82732	9.86958	9.95773	10.04226	47
14	9.82746	9.86947	9.95799	10.04200	46
15	9.82760	9.86935	9.95824	10.04175	45
16	9.82774	9.86924	9.95850	10.04149	44
17	9.82788	9.86913	9.95875	10.04124	43
18	9.82802	9.86901	9.95900	10.04099	42
19	9.82816	9.86890	9.95926	10.04073	41
20	9.82830	9.86878	9.95951	10.04048	40
21	9.82843	9.86867	9.95976	10.04023	39
22	9.82857	9.86855	9.96002	10.03997	38
23	9.82871	9.86843	9.96027	10.03972	37
24	9.82885	9.86832	9.96053	10.03946	36
25	9.82899	9.86820	9.96078	10.03921	35
26	9.82913	9.86809	9.96103	10.03896	34
27	9.82926	9.86797	9.96129	10.03870	33
28	9.82940	9.86786	9.96154	10.03845	32
29	9.82954	9.86774	9.96179	10.03820	31
30	9.82968	9.86763	9.96205	10.03794	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ

Min.	43 Degrees.				136
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.83378	9.86412	9.96965	10.03034	60
1	9.83391	9.86400	9.96990	10.03009	59
2	9.83405	9.86389	9.97016	10.02983	58
3	9.83418	9.86377	9.97041	10.02958	57
4	9.83432	9.86365	9.97066	10.02933	56
5	9.83445	9.86353	9.97092	10.02907	55
6	9.83459	9.86341	9.97117	10.02882	54
7	9.83472	9.86330	9.97142	10.02857	53
8	9.83486	9.86318	9.97168	10.02831	52
9	9.83499	9.86306	9.97193	10.02806	51
10	9.83513	9.86294	9.97218	10.02781	50
11	9.83526	9.86282	9.97244	10.02755	49
12	9.83540	9.86270	9.97269	10.02730	48
13	9.83553	9.86259	9.97294	10.02705	47
14	9.83567	9.86247	9.97320	10.02679	46
15	9.83580	9.86235	9.97345	10.02654	45
16	9.83594	9.86223	9.97370	10.02629	44
17	9.83607	9.86211	9.97396	10.02603	43
18	9.83620	9.86199	9.97421	10.02578	42
19	9.83634	9.86187	9.97446	10.02553	41
20	9.83647	9.86175	9.97471	10.02528	40
21	9.83661	9.86163	9.97497	10.02502	39
22	9.83674	9.86151	9.97522	10.02477	38
23	9.83687	9.86139	9.97547	10.02452	37
24	9.83701	9.86128	9.97573	10.02426	36
25	9.83714	9.86116	9.97598	10.02401	35
26	9.83737	9.86104	9.97623	10.02376	34
27	9.83741	9.86092	9.97649	10.02350	33
28	9.83754	9.86080	9.97674	10.02325	32
29	9.83767	9.86068	9.97699	10.02300	31
30	9.83781	9.86056	9.97725	10.02275	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
133					46 Degrees.

Min.	43 Degrees.				136	
	Sine.	Cofine.	Tangent.	Cotang.		
30	9.83781	9.86056	9.97725	10.02275	30	
31	9.83794	9.86044	9.97750	10.02249	29	
32	9.83807	9.86032	9.97775	10.02224	28	
33	9.83821	9.86020	9.97800	10.02199	27	
34	9.83834	9.86008	9.97826	10.02173	26	
35	9.83847	9.85996	9.97851	10.02148	25	
36	9.83860	9.85984	9.97876	10.02123	24	
37	9.83874	9.85972	9.97902	10.02097	23	
38	9.83887	9.85960	9.97927	10.02072	22	
39	9.83900	9.85948	9.97952	10.02047	21	
40	9.83913	9.85935	9.97977	10.02022	20	
41	9.83927	9.85923	9.98003	10.01996	19	
42	9.83940	9.85911	9.98028	10.01971	18	
43	9.83953	9.85899	9.98053	10.01946	17	
44	9.83966	9.85887	9.98079	10.01920	16	
45	9.83980	9.85875	9.98104	10.01895	15	
46	9.83993	9.85863	9.98129	10.01870	14	
47	9.84006	9.85851	9.98155	10.01844	13	
48	9.84019	9.85839	9.98180	10.01819	12	
49	9.84032	9.85827	9.98205	10.01794	11	
50	9.84045	9.85815	9.98230	10.01769	10	
51	9.84059	9.85802	9.98256	10.01743	9	
52	9.84072	9.85790	9.98281	10.01718	8	
53	9.84085	9.85778	9.98306	10.01693	7	
54	9.84098	9.85766	9.98332	10.01667	6	
55	9.84111	9.85754	9.98357	10.01642	5	
56	9.84124	9.85742	9.98382	10.01617	4	
57	9.84137	9.85729	9.98407	10.01592	3	
58	9.84150	9.85717	9.98433	10.01566	2	
59	9.84164	9.85705	9.98458	10.01541	1	
60	9.84177	9.85693	9.98483	10.01516	0	
	Cofine.	Sine.	Cotang.	Tangent.	M	
133					46 Degrees.	

Min.	44 Degrees.				135
	Sine.	Cofine.	Tangent.	Cotang.	
0	9.84177	9.85693	9.98483	10.01516	60
1	9.84190	9.85681	9.98509	10.01491	59
2	9.84203	9.85669	9.98534	10.01465	58
3	9.84216	9.85656	9.98559	10.01440	57
4	9.84229	9.85644	9.98584	10.01415	56
5	9.84242	9.85632	9.98610	10.01389	55
6	9.84255	9.85620	9.98635	10.01364	54
7	9.84268	9.85607	9.98660	10.01339	53
8	9.84281	9.85595	9.98685	10.01314	52
9	9.84294	9.85583	9.98711	10.01288	51
10	9.84307	9.85571	9.98736	10.01263	50
11	9.84320	9.85558	9.98761	10.01238	49
12	9.84333	9.85546	9.98787	10.01212	48
13	9.84346	9.85534	9.98812	10.01187	47
14	9.84359	9.85521	9.98837	10.01162	46
15	9.84372	9.85509	9.98862	10.01137	45
16	9.84385	9.85497	9.98888	10.01111	44
17	9.84398	9.85484	9.98913	10.01086	43
18	9.84411	9.85472	9.98938	10.01061	42
19	9.84424	9.85460	9.98963	10.01036	41
20	9.84437	9.85447	9.98989	10.01010	40
21	9.84450	9.85435	9.99014	10.00985	39
22	9.84463	9.85423	9.99039	10.00960	38
23	9.84476	9.85410	9.99065	10.00934	37
24	9.84488	9.85398	9.99090	10.00909	36
25	9.84501	9.85386	9.99115	10.00884	35
26	9.84514	9.85373	9.99140	10.00859	34
27	9.84527	9.85361	9.99166	10.00833	33
28	9.84540	9.85349	9.99191	10.00808	32
29	9.84553	9.85336	9.99216	10.00783	31
30	9.84566	9.85324	9.99241	10.00758	30
	Cofine.	Sine.	Cotang.	Tangent.	Σ
134					45 Degrees.

Min.	44 Degrees.				135
	Sine.	Cofine.	Tangent.	Cotang.	
30	9.84566	9.85324	9.99241	10.00758	30
31	9.84579	9.85311	9.99267	10.00732	29
32	9.84591	9.85299	9.99292	10.00707	28
33	9.84604	9.85286	9.99317	10.00682	27
34	9.84617	9.85274	9.99343	10.00656	26
35	9.84630	9.85262	9.99368	10.00631	25
36	9.84643	9.85249	9.99393	10.00606	24
37	9.84655	9.85237	9.99418	10.00581	23
38	9.84668	9.85224	9.99444	10.00555	22
39	9.84681	9.85212	9.99469	10.00530	21
40	9.84694	9.85199	9.99494	10.00505	20
41	9.84707	9.85187	9.99519	10.00480	19
42	9.84719	9.85174	9.99545	10.00454	18
43	9.84732	9.85162	9.99570	10.00429	17
44	9.84745	9.85149	9.99595	10.00404	16
45	9.84758	9.85137	9.99621	10.00379	15
46	9.84770	9.85124	9.99646	10.00353	14
47	9.84783	9.85112	9.99671	10.00328	13
48	9.84796	9.85099	9.99696	10.00303	12
49	9.84809	9.85087	9.99722	10.00277	11
50	9.84821	9.85074	9.99747	10.00252	10
51	9.84834	9.85061	9.99772	10.00227	9
52	9.84847	9.85049	9.99797	10.00202	8
53	9.84859	9.85036	9.99823	10.00176	7
54	9.84872	9.85024	9.99848	10.00151	6
55	9.84885	9.85011	9.99873	10.00126	5
56	9.84897	9.84998	9.99898	10.00101	4
57	9.84910	9.84986	9.99924	10.00075	3
58	9.84923	9.84973	9.99949	10.00050	2
59	9.84935	9.84961	9.99974	10.00025	1
60	9.84948	9.84948	10.00000	10.00000	0
	Cofine.	Sine.	Cotang.	Tangent.	N

A
T A B L E
OF THE
L O G A R I T H M S
O F
N U M B E R S, from 1 to 2000,

*To find the Logarithm of a given Number; and
the contrary.*

R U L E.

Find the Number in the Column *Num.* and against it is its Logarithm, in the Column *Logar.* Likewise, if the Log. be given, seek the nearest in the Table, and against it is the correspondent Number.

Thus, the Log. of 45 is 1.65321; and the Log. of 1857 is 3.26881.

And, if the Log. be 2.92648, the nearest Log. in the Table is 2.92634, whose Number is 844.

Note, It may happen, that the Log. of a Number may be wanted, which exceeds the Table. In this Case, find the Log. of the 10th Part of the Number, and add 1 to the *Characteristic*, which is the first Figure on the left Hand. Thus, for the Number 7150, the Log. of 715 is 2.85430; and of 7150 is 3.85430.

Num	Logarith	Num	Logarith	Num	Logarith
1	0.00000	34	1.53147	67	1.82607
2	0.30103	35	1.54406	68	1.83250
3	0.47712	36	1.55630	69	1.83884
4	0.60206	37	1.56820	70	1.84509
5	0.69897	38	1.57978	71	1.85125
6	0.77815	39	1.59106	72	1.85733
7	0.84509	40	1.60206	73	1.86332
8	0.90309	41	1.61278	74	1.86923
9	0.95424	42	1.62324	75	1.87506
10	1.00000	43	1.63346	76	1.88081
11	1.04139	44	1.64345	77	1.88649
12	1.07918	45	1.65321	78	1.89209
13	1.11394	46	1.66275	79	1.89762
14	1.14612	47	1.67209	80	1.90309
15	1.17609	48	1.68124	81	1.90848
16	1.20412	49	1.69019	82	1.91381
17	1.23044	50	1.69897	83	1.91907
18	1.25527	51	1.70757	84	1.92427
19	1.27875	52	1.71600	85	1.92941
20	1.30103	53	1.72427	86	1.93449
21	1.32221	54	1.73239	87	1.93951
22	1.34242	55	1.74036	88	1.94448
23	1.36172	56	1.74818	89	1.94939
24	1.38021	57	1.75587	90	1.95424
25	1.39794	58	1.76342	91	1.95904
26	1.41497	59	1.77085	92	1.96378
27	1.43136	60	1.77815	93	1.96848
28	1.44715	61	1.78532	94	1.97312
29	1.46239	62	1.79239	95	1.97772
30	1.47712	63	1.79934	96	1.98227
31	1.49136	64	1.80618	97	1.98677
32	1.50515	65	1.81291	98	1.99122
33	1.51851	66	1.81954	99	1.99563
34	1.53147	67	1.82607	100	2.00000

Num	Logarith	Num	Logarith	Num	Logarith
101	2.00432	134	2.12710	167	2.22271
102	2.00860	135	2.13033	168	2.22530
103	2.01283	136	2.13353	169	2.22788
104	2.01703	137	2.13672	170	2.23044
105	2.02118	138	2.13987	171	2.23299
106	2.02530	139	2.14301	172	2.23552
107	2.02938	140	2.14612	173	2.23804
108	2.03342	141	2.14921	174	2.24054
109	2.03742	142	2.15228	175	2.24303
110	2.04139	143	2.15533	176	2.24551
111	2.04532	144	2.15836	177	2.24797
112	2.04921	145	2.16136	178	2.25042
113	2.05307	146	2.16435	179	2.25285
114	2.05690	147	2.16731	180	2.25527
115	2.06069	148	2.17026	181	2.25767
116	2.06445	149	2.17318	182	2.26007
117	2.06818	150	2.17609	183	2.26245
118	2.07188	151	2.17897	184	2.26481
119	2.07554	152	2.18184	185	2.26717
120	2.07918	153	2.18469	186	2.26951
121	2.08278	154	2.18752	187	2.27184
122	2.08635	155	2.19033	188	2.27415
123	2.08990	156	2.19312	189	2.27646
124	2.09342	157	2.19589	190	2.27875
125	2.09691	158	2.19865	191	2.28103
126	2.10037	159	2.20139	192	2.28330
127	2.10380	160	2.20412	193	2.28555
128	2.10721	161	2.20682	194	2.28780
129	2.11058	162	2.20951	195	2.29003
130	2.11394	163	2.21218	196	2.29225
131	2.11727	164	2.21484	197	2.29446
132	2.12057	165	2.21748	198	2.29666
133	2.12385	166	2.22010	199	2.29885
134	2.12710	167	2.22271	200	2.30103

Num	Logarith	Num	Logarith	Num	Logarith
201	2.30319	234	2.36921	267	2.42651
202	2.30535	235	2.37106	268	2.42813
203	2.30749	236	2.37291	269	2.42975
204	2.30963	237	2.37474	270	2.43136
205	2.31175	238	2.37657	271	2.43296
206	2.31386	239	2.37839	272	2.43456
207	2.31597	240	2.38021	273	2.43616
208	2.31806	241	2.38201	274	2.43775
209	2.32014	242	2.38381	275	2.43933
210	2.32221	243	2.38560	276	2.44090
211	2.32428	244	2.38738	277	2.44247
212	2.32633	245	2.38916	278	2.44404
213	2.32837	246	2.39093	279	2.44560
214	2.33041	247	2.39269	280	2.44715
215	2.33243	248	2.39445	281	2.44870
216	2.33445	249	2.39619	282	2.45024
217	2.33645	250	2.39794	283	2.45178
218	2.33845	251	2.39967	284	2.45331
219	2.34044	252	2.40140	285	2.45484
220	2.34242	253	2.40312	286	2.45636
221	2.34439	254	2.40483	287	2.45788
222	2.34635	255	2.40654	288	2.45939
223	2.34830	256	2.40824	289	2.46089
224	2.35024	257	2.40993	290	2.46239
225	2.35218	258	2.41161	291	2.46389
226	2.35410	259	2.41329	292	2.46538
227	2.35602	260	2.41497	293	2.46686
228	2.35793	261	2.41664	294	2.46834
229	2.35983	262	2.41830	295	2.46982
230	2.36172	263	2.41995	296	2.47129
231	2.36361	264	2.42160	297	2.47275
232	2.36548	265	2.42324	298	2.47421
233	2.36735	266	2.42488	299	2.47567
234	2.36921	267	2.42651	300	2.47712

<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>
301	2.47856	334	2.52374	367	2.56466
302	2.48000	335	2.52504	368	2.56584
303	2.48144	336	2.52633	369	2.56702
304	2.48287	337	2.52762	370	2.56820
305	2.48420	338	2.52891	371	2.56937
306	2.48572	339	2.53019	372	2.57054
307	2.48713	340	2.53147	373	2.57170
308	2.48855	341	2.53275	374	2.57287
309	2.48995	342	2.53402	375	2.57403
310	2.49136	343	2.53529	376	2.57518
311	2.49276	344	2.53655	377	2.57634
312	2.49415	345	2.53781	378	2.57749
313	2.49554	346	2.53907	379	2.57863
314	2.49692	347	2.54032	380	2.57978
315	2.49831	348	2.54157	381	2.58092
316	2.49968	349	2.54282	382	2.58206
317	2.50105	350	2.54406	383	2.58319
318	2.50242	351	2.54530	384	2.58433
319	2.50379	352	2.54654	385	2.58546
320	2.50515	353	2.54777	386	2.58658
321	2.50650	354	2.54900	387	2.58771
322	2.50785	355	2.55022	388	2.58883
323	2.50920	356	2.55145	389	2.58994
324	2.51054	357	2.55266	390	2.59106
325	2.51188	358	2.55388	391	2.59217
326	2.51321	359	2.55509	392	2.59328
327	2.51454	360	2.55630	393	2.59439
328	2.51587	361	2.55750	394	2.59549
329	2.51719	362	2.55870	395	2.59659
330	2.51851	363	2.55990	396	2.59769
331	2.51982	364	2.56110	397	2.59879
332	2.52113	365	2.56229	398	2.59988
333	2.52244	366	2.56348	399	2.60097
334	2.52374	367	2.56466	400	2.60206

Num	Logarith	Num	Logarith	Num	Logarith
401	2.60314	434	2.63748	467	2.66931
402	2.60422	435	2.63848	468	2.67024
403	2.60530	436	2.63948	469	2.67117
404	2.60638	437	2.64048	470	2.67209
405	2.60745	438	2.64147	471	2.67302
406	2.60852	439	2.64246	472	2.67394
407	2.60959	440	2.64345	473	2.67486
408	2.61066	441	2.64443	474	2.67577
409	2.61172	442	2.64542	475	2.67669
410	2.61278	443	2.64640	476	2.67760
411	2.61384	444	2.64738	477	2.67851
412	2.61489	445	2.64836	478	2.67942
413	2.61595	446	2.64933	479	2.68033
414	2.61700	447	2.65030	480	2.68124
415	2.61804	448	2.65127	481	2.68214
416	2.61909	449	2.65224	482	2.68304
417	2.62013	450	2.65321	483	2.68394
418	2.62117	451	2.65417	484	2.68484
419	2.62221	452	2.65513	485	2.68574
420	2.62324	453	2.65609	486	2.68663
421	2.62428	454	2.65705	487	2.68752
422	2.62531	455	2.65801	488	2.68841
423	2.62634	456	2.65896	489	2.68930
424	2.62736	457	2.65991	490	2.69019
425	2.62838	458	2.66086	491	2.69108
426	2.62940	459	2.66181	492	2.69196
427	2.63042	460	2.66275	493	2.69284
428	2.63144	461	2.66370	494	2.69372
429	2.63245	462	2.66464	495	2.69460
430	2.63346	463	2.66558	496	2.69548
431	2.63447	464	2.66651	497	2.69635
432	2.63548	465	2.66745	498	2.69722
433	2.63648	466	2.66838	499	2.69810
434	2.63748	467	2.66931	500	2.69897

<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>
501	2.69983	534	2.72754	567	2.75358
502	2.70070	535	2.72835	568	2.75434
503	2.70156	536	2.72916	569	2.75511
504	2.70243	537	2.72997	570	2.75587
505	2.70329	538	2.73078	571	2.75663
506	2.70415	539	2.73158	572	2.75739
507	2.70500	540	2.73239	573	2.75815
508	2.70586	541	2.73319	574	2.75891
509	2.70671	542	2.73399	575	2.75966
510	2.70757	543	2.73479	576	2.76042
511	2.70842	544	2.73559	577	2.76117
512	2.70927	545	2.73639	578	2.76192
513	2.71011	546	2.73719	579	2.76267
514	2.71096	547	2.73798	580	2.76342
515	2.71180	548	2.73878	581	2.76417
516	2.71264	549	2.73957	582	2.76492
517	2.71349	550	2.74036	583	2.76566
518	2.71432	551	2.74115	584	2.76641
519	2.71516	552	2.74193	585	2.76715
520	2.71600	553	2.74272	586	2.76789
521	2.71683	554	2.74350	587	2.76863
522	2.71767	555	2.74429	588	2.76937
523	2.71850	556	2.74507	589	2.77011
524	2.71933	557	2.74585	590	2.77085
525	2.72015	558	2.74663	591	2.77158
526	2.72098	559	2.74741	592	2.77232
527	2.72181	560	2.74818	593	2.77305
528	2.72263	561	2.74896	594	2.77378
529	2.72345	562	2.74973	595	2.77451
530	2.72427	563	2.75050	596	2.77524
531	2.72509	564	2.75127	597	2.77597
532	2.72591	565	2.75204	598	2.77670
533	2.72672	566	2.75281	599	2.77742
534	2.72754	567	2.75358	600	2.77815

Num	Logarith	Num	Logarith	Num	Logarith
601	2.77887	634	2.80208	667	2.82412
602	2.77959	635	2.80277	668	2.82477
603	2.78031	636	2.80345	669	2.82542
604	2.78103	637	2.80413	670	2.82607
605	2.78175	638	2.80482	671	2.82672
606	2.78247	639	2.80550	672	2.82736
607	2.78318	640	2.80618	673	2.82801
608	2.78390	641	2.80685	674	2.82865
609	2.78461	642	2.80753	675	2.82930
610	2.78532	643	2.80821	676	2.82994
611	2.78604	644	2.80888	677	2.83058
612	2.78675	645	2.80955	678	2.83122
613	2.78746	646	2.81023	679	2.83186
614	2.78816	647	2.81090	680	2.83250
615	2.78887	648	2.81157	681	2.83314
616	2.78958	649	2.81224	682	2.83378
617	2.79028	650	2.81291	683	2.83442
618	2.79098	651	2.81358	684	2.83505
619	2.79169	652	2.81424	685	2.83569
620	2.79239	653	2.81491	686	2.83632
621	2.79309	654	2.81557	687	2.83695
622	2.79379	655	2.81624	688	2.83758
623	2.79448	656	2.81690	689	2.83821
624	2.79518	657	2.81756	690	2.83884
625	2.79588	658	2.81822	691	2.83947
626	2.79657	659	2.81888	692	2.84010
627	2.79726	660	2.81954	693	2.84073
628	2.79795	661	2.82020	694	2.84135
629	2.79865	662	2.82085	695	2.84198
630	2.79934	663	2.82151	696	2.84260
631	2.80002	664	2.82216	697	2.84323
632	2.80071	665	2.82282	698	2.84385
633	2.80140	666	2.82347	699	2.84447
634	2.80208	667	2.82412	700	2.84509

<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>
701	2.84571	734	2.86569	767	2.88479
702	2.84633	735	2.86628	768	2.88536
703	2.84695	736	2.86687	769	2.88592
704	2.84757	737	2.86746	770	2.88649
705	2.84818	738	2.86805	771	2.88705
706	2.84880	739	2.86864	772	2.88761
707	2.84941	740	2.86923	773	2.88817
708	2.85003	741	2.86981	774	2.88874
709	2.85064	742	2.87040	775	2.88930
710	2.85125	743	2.87098	776	2.88986
711	2.85186	744	2.87157	777	2.89042
712	2.85248	745	2.87215	778	2.89097
713	2.85308	746	2.87273	779	2.89153
714	2.85369	747	2.87332	780	2.89209
715	2.85430	748	2.87390	781	2.89265
716	2.85491	749	2.87448	782	2.89320
717	2.85551	750	2.87506	783	2.89376
718	2.85612	751	2.87563	784	2.89431
719	2.85672	752	2.87621	785	2.89486
720	2.85733	753	2.87679	786	2.89542
721	2.85793	754	2.87737	787	2.89597
722	2.85853	755	2.87794	788	2.89652
723	2.85913	756	2.87852	789	2.89707
724	2.85973	757	2.87909	790	2.89762
725	2.86033	758	2.87966	791	2.89817
726	2.86093	759	2.88024	792	2.89872
727	2.86153	760	2.88081	793	2.89927
728	2.86213	761	2.88138	794	2.89982
729	2.86272	762	2.88195	795	2.90036
730	2.86332	763	2.88252	796	2.90091
731	2.86391	764	2.88309	797	2.90145
732	2.86451	765	2.88366	798	2.90200
733	2.86510	766	2.88422	799	2.90254
734	2.86569	767	2.88479	800	2.90309

Num	Logarith	Num	Logarith	Num	Logar
801	2.90363	834	2.92116	867	2.93801
802	2.90417	835	2.92168	868	2.93851
803	2.90471	836	2.92220	869	2.93901
804	2.90525	837	2.92272	870	2.93951
805	2.90579	838	2.92324	871	2.94001
806	2.90633	839	2.92376	872	2.94051
807	2.90687	840	2.92427	873	2.94101
808	2.90741	841	2.92479	874	2.94151
809	2.90794	842	2.92531	875	2.94200
810	2.90848	843	2.92582	876	2.94250
811	2.90902	844	2.92634	877	2.94299
812	2.90955	845	2.92685	878	2.94349
813	2.91009	846	2.92737	879	2.94398
814	2.91062	847	2.92788	880	2.94448
815	2.91115	848	2.92839	881	2.94497
816	2.91169	849	2.92890	882	2.94546
817	2.91222	850	2.92941	883	2.94596
818	2.91275	851	2.92992	884	2.94645
819	2.91328	852	2.93043	885	2.94694
820	2.91381	853	2.93094	886	2.94743
821	2.91434	854	2.93145	887	2.94792
822	2.91487	855	2.93196	888	2.94841
823	2.91539	856	2.93247	889	2.94890
824	2.91592	857	2.93298	890	2.94939
825	2.91645	858	2.93348	891	2.94987
826	2.91698	859	2.93399	892	2.95036
827	2.91750	860	2.93449	893	2.95085
828	2.91803	861	2.93500	894	2.95133
829	2.91855	862	2.93550	895	2.95182
830	2.91907	863	2.93601	896	2.95230
831	2.91960	864	2.93651	897	2.95279
832	2.92012	865	2.93701	898	2.95327
833	2.92064	866	2.93751	899	2.95375
834	2.92116	867	2.93801	900	2.95424

<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>
901	2.95472	934	2.97034	967	2.98542
902	2.95520	935	2.97081	968	2.98587
903	2.95568	936	2.97127	969	2.98632
904	2.95616	937	2.97173	970	2.98677
905	2.95664	938	2.97220	971	2.98721
906	2.95712	939	2.97266	972	2.98766
907	2.95760	940	2.97312	973	2.98811
908	2.95808	941	2.97358	974	2.98855
909	2.95856	942	2.97405	975	2.98900
910	2.95904	943	2.97451	976	2.98944
911	2.95951	944	2.97497	977	2.98989
912	2.95999	945	2.97543	978	2.99033
913	2.96047	946	2.97589	979	2.99078
914	2.96094	947	2.97635	980	2.99122
915	2.96142	948	2.97680	981	2.99166
916	2.96189	949	2.97720	982	2.99211
917	2.96236	950	2.97772	983	2.99255
918	2.96284	951	2.97818	984	2.99299
919	2.96331	952	2.97863	985	2.99343
920	2.96378	953	2.97909	986	2.99387
921	2.96425	954	2.97954	987	2.99431
922	2.96473	955	2.98000	988	2.99475
923	2.96520	956	2.98045	989	2.99519
924	2.96567	957	2.98091	990	2.99563
925	2.96614	958	2.98136	991	2.99607
926	2.96661	959	2.98181	992	2.99651
927	2.96707	960	2.98227	993	2.99694
928	2.96754	961	2.98272	994	2.99738
929	2.96801	962	2.98317	995	2.99782
930	2.96848	963	2.98362	996	2.99825
931	2.96894	964	2.98407	997	2.99869
932	2.96941	965	2.98452	998	2.99913
933	2.96988	966	2.98497	999	2.99956
934	2.97034	967	2.98542	1000	3.00000

1000

<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>
1001	3.00043	1034	3.01452	1067	3.02816
1002	3.00086	1035	3.01494	1068	3.02857
1003	3.00130	1036	3.01535	1069	3.02897
1004	3.00173	1037	3.01577	1070	3.02938
1005	3.00216	1038	3.01619	1071	3.02978
1006	3.00259	1039	3.01661	1072	3.03019
1007	3.00302	1040	3.01703	1073	3.03059
1008	3.00346	1041	3.01745	1074	3.03100
1009	3.00389	1042	3.01786	1075	3.03140
1010	3.00432	1043	3.01828	1076	3.03181
1011	3.00475	1044	3.01870	1077	3.03221
1012	3.00518	1045	3.01911	1078	3.03261
1013	3.00560	1046	3.01953	1079	3.03302
1014	3.00603	1047	3.01994	1080	3.03342
1015	3.00646	1048	3.02036	1081	3.03382
1016	3.00689	1049	3.02077	1082	3.03422
1017	3.00732	1050	3.02118	1083	3.03462
1018	3.00774	1051	3.02160	1084	3.03502
1019	3.00817	1052	3.02201	1085	3.03542
1020	3.00860	1053	3.02242	1086	3.03582
1021	3.00902	1054	3.02284	1087	3.03622
1022	3.00945	1055	3.02325	1088	3.03662
1023	3.00987	1056	3.02366	1089	3.03702
1024	3.01029	1057	3.02407	1090	3.03742
1025	3.01072	1058	3.02448	1091	3.03782
1026	3.01114	1059	3.02489	1092	3.03822
1027	3.01157	1060	3.02530	1093	3.03862
1028	3.01199	1061	3.02571	1094	3.03901
1029	3.01241	1062	3.02612	1095	3.03941
1030	3.01283	1063	3.02653	1096	3.03981
1031	3.01325	1064	3.02694	1097	3.04020
1032	3.01367	1065	3.02734	1098	3.04060
1033	3.01410	1066	3.02775	1099	3.04099
1034	3.01452	1067	3.02816	1100	3.04139

<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>
1101	3.04178	1134	3.05461	1167	3.06707
1102	3.04218	1135	3.05499	1168	3.06744
1103	3.04257	1136	3.05537	1169	3.06781
1104	3.04296	1137	3.05576	1170	3.06818
1105	3.04336	1138	3.05614	1171	3.06855
1106	3.04375	1139	3.05652	1172	3.06892
1107	3.04414	1140	3.05690	1173	3.06929
1108	3.04453	1141	3.05728	1174	3.06966
1109	3.04493	1142	3.05766	1175	3.07003
1110	3.04532	1143	3.05804	1176	3.07040
1111	3.04571	1144	3.05842	1177	3.07077
1112	3.04610	1145	3.05880	1178	3.07114
1113	3.04649	1146	3.05918	1179	3.07151
1114	3.04688	1147	3.05956	1180	3.07188
1115	3.04727	1148	3.05994	1181	3.07224
1116	3.04766	1149	3.06032	1182	3.07261
1117	3.04805	1150	3.06069	1183	3.07298
1118	3.04844	1151	3.06107	1184	3.07335
1119	3.04883	1152	3.06145	1185	3.07371
1120	3.04921	1153	3.06182	1186	3.07408
1121	3.04960	1154	3.06220	1187	3.07445
1122	3.04999	1155	3.06258	1188	3.07481
1123	3.05037	1156	3.06295	1189	3.07518
1124	3.05076	1157	3.06333	1190	3.07554
1125	3.05115	1158	3.06370	1191	3.07591
1126	3.05153	1159	3.06408	1192	3.07627
1127	3.05192	1160	3.06445	1193	3.07664
1128	3.05230	1161	3.06483	1194	3.07700
1129	3.05269	1162	3.06520	1195	3.07736
1130	3.05307	1163	3.06557	1196	3.07773
1131	3.05346	1164	3.06595	1197	3.07809
1132	3.05384	1165	3.06632	1198	3.07845
1133	3.05422	1166	3.06669	1199	3.07881
1134	3.05461	1167	3.06707	1200	3.07918

<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>
1201	3.07954	1234	3.09131	1267	3.10277
1202	3.07990	1235	3.09166	1268	3.10311
1203	3.08026	1236	3.09201	1269	3.10346
1204	3.08062	1237	3.09236	1270	3.10380
1205	3.08098	1238	3.09272	1271	3.10414
1206	3.08134	1239	3.09307	1272	3.10448
1207	3.08170	1240	3.09342	1273	3.10482
1208	3.08206	1241	3.09377	1274	3.10516
1209	3.08242	1242	3.09412	1275	3.10551
1210	3.08278	1243	3.09447	1276	3.10585
1211	3.08314	1244	3.09482	1277	3.10619
1212	3.08350	1245	3.09516	1278	3.10653
1213	3.08386	1246	3.09551	1279	3.10687
1214	3.08421	1247	3.09586	1280	3.10721
1215	3.08457	1248	3.09621	1281	3.10754
1216	3.08493	1249	3.09656	1282	3.10788
1217	3.08529	1250	3.09691	1283	3.10822
1218	3.08564	1251	3.09725	1284	3.10856
1219	3.08600	1252	3.09760	1285	3.10890
1220	3.08635	1253	3.09795	1286	3.10924
1221	3.08671	1254	3.09829	1287	3.10957
1222	3.08707	1255	3.09864	1288	3.10991
1223	3.08742	1256	3.09898	1289	3.11025
1224	3.08778	1257	3.09933	1290	3.11058
1225	3.08813	1258	3.09968	1291	3.11092
1226	3.08849	1259	3.10002	1292	3.11126
1227	3.08884	1260	3.10037	1293	3.11159
1228	3.08919	1261	3.10071	1294	3.11193
1229	3.08955	1262	3.10105	1295	3.11226
1230	3.08990	1263	3.10140	1296	3.11260
1231	3.09025	1264	3.10174	1297	3.11294
1232	3.09061	1265	3.10209	1298	3.11327
1233	3.09096	1266	3.10243	1299	3.11360
1234	3.09131	1267	3.10277	1300	3.11394

<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>
1301	3.11427	1334	3.12515	1367	3.13576
1302	3.11461	1335	3.12548	1368	3.13608
1303	3.11494	1336	3.12580	1369	3.13640
1304	3.11527	1337	3.12613	1370	3.13672
1305	3.11561	1338	3.12645	1371	3.13703
1306	3.11594	1339	3.12678	1372	3.13735
1307	3.11627	1340	3.12710	1373	3.13767
1308	3.11660	1341	3.12742	1374	3.13798
1309	3.11693	1342	3.12775	1375	3.13830
1310	3.11727	1343	3.12807	1376	3.13861
1311	3.11760	1344	3.12839	1377	3.13893
1312	3.11793	1345	3.12872	1378	3.13924
1313	3.11826	1346	3.12904	1379	3.13956
1314	3.11859	1347	3.12936	1380	3.13987
1315	3.11892	1348	3.12968	1381	3.14019
1316	3.11925	1349	3.13001	1382	3.14050
1317	3.11958	1350	3.13033	1383	3.14082
1318	3.11991	1351	3.13065	1384	3.14113
1319	3.12024	1352	3.13097	1385	3.14144
1320	3.12057	1353	3.13129	1386	3.14176
1321	3.12090	1354	3.13161	1387	3.14207
1322	3.12123	1355	3.13193	1388	3.14238
1323	3.12155	1356	3.13225	1389	3.14270
1324	3.12188	1357	3.13257	1390	3.14301
1325	3.12221	1358	3.13289	1391	3.14332
1326	3.12254	1359	3.13321	1392	3.14363
1327	3.12287	1360	3.13353	1393	3.14395
1328	3.12319	1361	3.13385	1394	3.14426
1329	3.12352	1362	3.13417	1395	3.14457
1330	3.12385	1363	3.13449	1396	3.14488
1331	3.12417	1364	3.13481	1397	3.14519
1332	3.12450	1365	3.13513	1398	3.14550
1333	3.12483	1366	3.13545	1399	3.14581
1334	3.12515	1367	3.13576	1400	3.14612

<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>
1401	3.14643	1434	3.15654	1467	3.16643
1402	3.14674	1435	3.15685	1468	3.16672
1403	3.14705	1436	3.15715	1469	3.16702
1404	3.14736	1437	3.15745	1470	3.16731
1405	3.14767	1438	3.15775	1471	3.16761
1406	3.14798	1439	3.15806	1472	3.16790
1407	3.14829	1440	3.15836	1473	3.16820
1408	3.14860	1441	3.15866	1474	3.16849
1409	3.14891	1442	3.15896	1475	3.16879
1410	3.14921	1443	3.15926	1476	3.16908
1411	3.14952	1444	3.15956	1477	3.16938
1412	3.14983	1445	3.15986	1478	3.16967
1413	3.15014	1446	3.16016	1479	3.16996
1414	3.15044	1447	3.16046	1480	3.17026
1415	3.15075	1448	3.16076	1481	3.17055
1416	3.15106	1449	3.16106	1482	3.17084
1417	3.15136	1450	3.16136	1483	3.17114
1418	3.15167	1451	3.16166	1484	3.17143
1419	3.15198	1452	3.16196	1485	3.17172
1420	3.15228	1453	3.16226	1486	3.17201
1421	3.15259	1454	3.16256	1487	3.17231
1422	3.15289	1455	3.16286	1488	3.17260
1423	3.15320	1456	3.16316	1489	3.17289
1424	3.15351	1457	3.16345	1490	3.17318
1425	3.15381	1458	3.16375	1491	3.17347
1426	3.15411	1459	3.16405	1492	3.17376
1427	3.15442	1460	3.16435	1493	3.17405
1428	3.15472	1461	3.16465	1494	3.17435
1429	3.15503	1462	3.16494	1495	3.17464
1430	3.15533	1463	3.16524	1496	3.17493
1431	3.15563	1464	3.16554	1497	3.17522
1432	3.15594	1465	3.16583	1498	3.17551
1433	3.15624	1466	3.16613	1499	3.17580
1434	3.15654	1467	3.16643	1500	3.17609

<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>
1501	3.17638	1534	3.18582	1567	3.19500
1502	3.17666	1535	3.18610	1568	3.19534
1503	3.17695	1536	3.18639	1569	3.19562
1504	3.17724	1537	3.18667	1570	3.19589
1505	3.17753	1538	3.18695	1571	3.19617
1506	3.17782	1539	3.18723	1572	3.19645
1507	3.17811	1540	3.18752	1573	3.19672
1508	3.17840	1541	3.18780	1574	3.19700
1509	3.17868	1542	3.18808	1575	3.19728
1510	3.17897	1543	3.18836	1576	3.19755
1511	3.17926	1544	3.18864	1577	3.19783
1512	3.17955	1545	3.18892	1578	3.19810
1513	3.17983	1546	3.18920	1579	3.19838
1514	3.18012	1547	3.18949	1580	3.19865
1515	3.18041	1548	3.18977	1581	3.19893
1516	3.18069	1549	3.19005	1582	3.19920
1517	3.18098	1550	3.19033	1583	3.19948
1518	3.18127	1551	3.19061	1584	3.19975
1519	3.18155	1552	3.19089	1585	3.20002
1520	3.18184	1553	3.19117	1586	3.20030
1521	3.18212	1554	3.19145	1587	3.20057
1522	3.18241	1555	3.19173	1588	3.20085
1523	3.18269	1556	3.19200	1589	3.20112
1524	3.18298	1557	3.19228	1590	3.20139
1525	3.18326	1558	3.19256	1591	3.20167
1526	3.18355	1559	3.19284	1592	3.20194
1527	3.18383	1560	3.19312	1593	3.20221
1528	3.18412	1561	3.19340	1594	3.20248
1529	3.18440	1562	3.19368	1595	3.20276
1530	3.18469	1563	3.19395	1596	3.20303
1531	3.18497	1564	3.19423	1597	3.20330
1532	3.18525	1565	3.19451	1598	3.20357
1533	3.18554	1566	3.19479	1599	3.20384
1534	3.18582	1567	3.19506	1600	3.20412

<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>
1601	3.20439	1634	3.21325	1667	3.22193
1602	3.20466	1635	3.21351	1668	3.22219
1603	3.20493	1636	3.21378	1669	3.22245
1604	3.20520	1637	3.21404	1670	3.22271
1605	3.20547	1638	3.21431	1671	3.22297
1606	3.20574	1639	3.21457	1672	3.22323
1607	3.20601	1640	3.21484	1673	3.22349
1608	3.20628	1641	3.21510	1674	3.22375
1609	3.20655	1642	3.21537	1675	3.22401
1610	3.20682	1643	3.21563	1676	3.22427
1611	3.20709	1644	3.21590	1677	3.22453
1612	3.20736	1645	3.21616	1678	3.22479
1613	3.20763	1646	3.21642	1679	3.22505
1614	3.20790	1647	3.21669	1680	3.22530
1615	3.20817	1648	3.21695	1681	3.22556
1616	3.20844	1649	3.21722	1682	3.22582
1617	3.20871	1650	3.21748	1683	3.22608
1618	3.20897	1651	3.21774	1684	3.22634
1619	3.20924	1652	3.21801	1685	3.22659
1620	3.20951	1653	3.21827	1686	3.22685
1621	3.20978	1654	3.21853	1687	3.22711
1622	3.21005	1655	3.21879	1688	3.22737
1623	3.21031	1656	3.21906	1689	3.22762
1624	3.21058	1657	3.21932	1690	3.22788
1625	3.21085	1658	3.21958	1691	3.22814
1626	3.21112	1659	3.21984	1692	3.22840
1627	3.21138	1660	3.22010	1693	3.22865
1628	3.21165	1661	3.22036	1694	3.22891
1629	3.21192	1662	3.22063	1695	3.22916
1630	3.21218	1663	3.22089	1696	3.22942
1631	3.21245	1664	3.22115	1697	3.22968
1632	3.21272	1665	3.22141	1698	3.22993
1633	3.21298	1666	3.22167	1699	3.23019
1634	3.21325	1667	3.22193	1700	3.23044

<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>
1701	3.23070	1734	3.23904	1767	3.24723
1702	3.23095	1735	3.23929	1768	3.24748
1703	3.23121	1736	3.23954	1769	3.24772
1704	3.23146	1737	3.23979	1770	3.24797
1705	3.23172	1738	3.24004	1771	3.24821
1706	3.23197	1739	3.24029	1772	3.24846
1707	3.23223	1740	3.24054	1773	3.24870
1708	3.23248	1741	3.24079	1774	3.24895
1709	3.23274	1742	3.24104	1775	3.24919
1710	3.23299	1743	3.24129	1776	3.24944
1711	3.23325	1744	3.24154	1777	3.24968
1712	3.23350	1745	3.24179	1778	3.24993
1713	3.23375	1746	3.24204	1779	3.25017
1714	3.23401	1747	3.24229	1780	3.25042
1715	3.23426	1748	3.24254	1781	3.25066
1716	3.23451	1749	3.24278	1782	3.25090
1717	3.23477	1750	3.24303	1783	3.25115
1718	3.23502	1751	3.24328	1784	3.25139
1719	3.23527	1752	3.24353	1785	3.25163
1720	3.23552	1753	3.24378	1786	3.25188
1721	3.23578	1754	3.24402	1787	3.25212
1722	3.23603	1755	3.24427	1788	3.25236
1723	3.23628	1756	3.24452	1789	3.25261
1724	3.23653	1757	3.24477	1790	3.25281
1725	3.23678	1758	3.24501	1791	3.25309
1726	3.23704	1759	3.24526	1792	3.25333
1727	3.23729	1760	3.24551	1793	3.25358
1728	3.23754	1761	3.24575	1794	3.25382
1729	3.23779	1762	3.24600	1795	3.25406
1730	3.23804	1763	3.24625	1796	3.25430
1731	3.23829	1764	3.24649	1797	3.25454
1732	3.23854	1765	3.24674	1798	3.25478
1733	3.23879	1766	3.24699	1799	3.25503
1734	3.23904	1767	3.24723	1800	3.25527

<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>
1801	3.25551	1834	3.26339	1867	3.27114
1802	3.25575	1835	3.26363	1868	3.27137
1803	3.25599	1836	3.26387	1869	3.27160
1804	3.25623	1837	3.26410	1870	3.27184
1805	3.25647	1838	3.26434	1871	3.27207
1806	3.25671	1839	3.26458	1872	3.27230
1807	3.25695	1840	3.26481	1873	3.27253
1808	3.25719	1841	3.26505	1874	3.27276
1809	3.25743	1842	3.26528	1875	3.27300
1810	3.25767	1843	3.26552	1876	3.27323
1811	3.25791	1844	3.26576	1877	3.27346
1812	3.25815	1845	3.26599	1878	3.27369
1813	3.25839	1846	3.26623	1879	3.27392
1814	3.25863	1847	3.26646	1880	3.27415
1815	3.25887	1848	3.26670	1881	3.27438
1816	3.25911	1849	3.26693	1882	3.27461
1817	3.25935	1850	3.26717	1883	3.27485
1818	3.25959	1851	3.26740	1884	3.27508
1819	3.25983	1852	3.26764	1885	3.27531
1820	3.26007	1853	3.26787	1886	3.27554
1821	3.26030	1854	3.26810	1887	3.27577
1822	3.26054	1855	3.26834	1888	3.27600
1823	3.26078	1856	3.26857	1889	3.27623
1824	3.26102	1857	3.26881	1890	3.27646
1825	3.26126	1858	3.26904	1891	3.27669
1826	3.26150	1859	3.26927	1892	3.27692
1827	3.26173	1860	3.26951	1893	3.27715
1828	3.26197	1861	3.26974	1894	3.27738
1829	3.26221	1862	3.26997	1895	3.27760
1830	3.26245	1863	3.27021	1896	3.27783
1831	3.26268	1864	3.27044	1897	3.27806
1832	3.26292	1865	3.27067	1898	3.27829
1833	3.26316	1866	3.27091	1899	3.27852
1834	3.26339	1867	3.27114	1900	3.27875

1900

<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>	<i>Num</i>	<i>Logarith</i>
1901	3.27898	1934	3.28645	1967	3.29380
1902	3.27921	1935	3.28668	1968	3.29402
1903	3.27943	1936	3.28690	1969	3.29424
1904	3.27966	1937	3.28712	1970	3.29446
1905	3.27989	1938	3.28735	1971	3.29468
1906	3.28012	1939	3.28757	1972	3.29490
1907	3.28035	1940	3.28780	1973	3.29512
1908	3.28057	1941	3.28802	1974	3.29534
1909	3.28080	1942	3.28824	1975	3.29556
1910	3.28103	1943	3.28847	1976	3.29578
1911	3.28126	1944	3.28869	1977	3.29600
1912	3.28148	1945	3.28891	1978	3.29622
1913	3.28171	1946	3.28914	1979	3.29644
1914	3.28194	1947	3.28936	1980	3.29666
1915	3.28216	1948	3.28958	1981	3.29688
1916	3.28239	1949	3.28981	1982	3.29710
1917	3.28262	1950	3.29003	1983	3.29732
1918	3.28284	1951	3.29025	1984	3.29754
1919	3.28307	1952	3.29047	1985	3.29776
1920	3.28330	1953	3.29070	1986	3.29797
1921	3.28352	1954	3.29092	1987	3.29819
1922	3.28375	1955	3.29114	1988	3.29841
1923	3.28397	1956	3.29136	1989	3.29863
1924	3.28420	1957	3.29159	1990	3.29885
1925	3.28443	1958	3.29181	1991	3.29907
1926	3.28465	1959	3.29203	1992	3.29928
1927	3.28488	1960	3.29225	1993	3.29950
1928	3.28510	1961	3.29247	1994	3.29972
1929	3.28533	1962	3.29269	1995	3.29994
1930	3.28555	1963	3.29292	1996	3.30016
1931	3.28578	1964	3.29314	1997	3.30037
1932	3.28600	1965	3.29336	1998	3.30059
1933	3.28623	1966	3.29358	1999	3.30081
1934	3.28645	1967	3.29380	2000	3.30103

A TABLE of the Angles, which every Point of the Compass makes with the Meridian. Serving, by Inspection, to turn the Rumbs into Degrees; and the contrary.

<i>Rumbs.</i>	<i>Rumbs.</i>	<i>Points.</i>	<i>D. M.</i>	<i>Rumbs.</i>	<i>Rumbs.</i>
<i>North.</i>	<i>South.</i>	0	0 0	<i>North.</i>	<i>South.</i>
		$0\frac{1}{4}$	2 49		
		$0\frac{1}{2}$	5 37		
		$0\frac{3}{4}$	8 26		
N. by E.	S. by E.	1	11 15	N. by W.	S. by W.
		$1\frac{1}{4}$	14 4		
		$1\frac{1}{2}$	16 52		
		$1\frac{3}{4}$	19 41		
N. N. E.	S. S. E.	2	22 30	N. N. W.	S. S. W.
		$2\frac{1}{4}$	25 19		
		$2\frac{1}{2}$	28 7		
		$2\frac{3}{4}$	30 56		
N. E. by N.	S. E. by S.	3	33 45	N. W. by N.	S. W. by S.
		$3\frac{1}{4}$	36 34		
		$3\frac{1}{2}$	39 22		
		$3\frac{3}{4}$	42 11		
N. E.	S. E.	4	45 0	N. W.	S. W.
		$4\frac{1}{4}$	47 49		
		$4\frac{1}{2}$	50 38		
		$4\frac{3}{4}$	53 26		
N. E. by E.	S. F. by E.	5	56 15	N. W. by W.	S. W. by W.
		$5\frac{1}{4}$	59 4		
		$5\frac{1}{2}$	61 53		
		$5\frac{3}{4}$	64 41		
E. N. E.	E. S. E.	6	67 30	W. N. W.	W. S. W.
		$6\frac{1}{4}$	70 19		
		$6\frac{1}{2}$	73 8		
		$6\frac{3}{4}$	75 56		
E. by N.	E. by S.	7	78 45	W. by N.	W. by S.
		$7\frac{1}{4}$	81 34		
		$7\frac{1}{2}$	84 23		
		$7\frac{3}{4}$	87 11		
East.	East.	8	90 0	West.	West.

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